THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVI. No. 1437.] LONDON, NOVEMBER 25, 1890. [42ND YEAR. Price 6d.

WOLSTON'S Paste and Ready Mixed **TORBAY** for Use. Guaranteed Free from Adulteration. **PANTS.**

FOR GASHOLDERS, &c., &c.

The Original "Torbay Paints" As supplied during the present and many preceding years to the LONDON GASLIGHT & COKE COMPANY.

Special Quotations to Gas Companies.

TORBAY & DART PAINT Co., Ld.,
23, Gt. George St., Westminster, S.W.
Works: DARTMOUTH, DEVON.

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PARKER & LESTER,
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THE ONLY MAKERS OF
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Parker's Imperial Black Varnish,
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WORKS:
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Ashmore, Benson, Pease, & Co., Ld.,
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Manufacturing Gas Engineers.
See Advertisement, p. 820.

CEMENT
EARLE'S
BEST
Portland Cement
MANUFACTURED BY
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STOREAGE CAPACITY 10,000 Tons.

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FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
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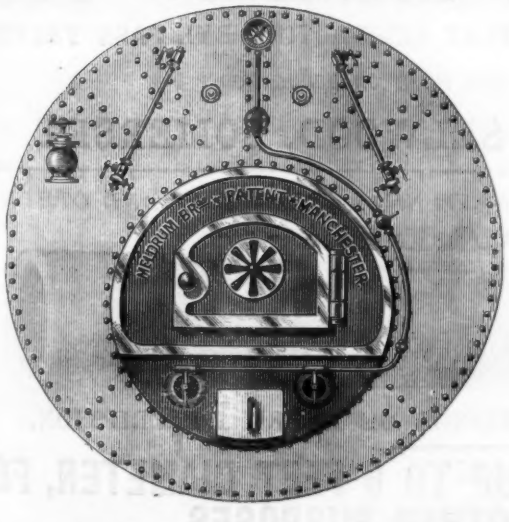
LE GRAND & SUTCLIFF,
HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

SELF-CONTAINED DUST FUEL FURNACE.



OVER 200 WORKING,
RAISING STEAM WITH COKE DUST, COAL DUST, TOWNS' REFUSE, AND OTHER WASTE FUEL.

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(ESTABLISHED 1765),

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

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EDWARD COCKEY & SONS, Ld.,

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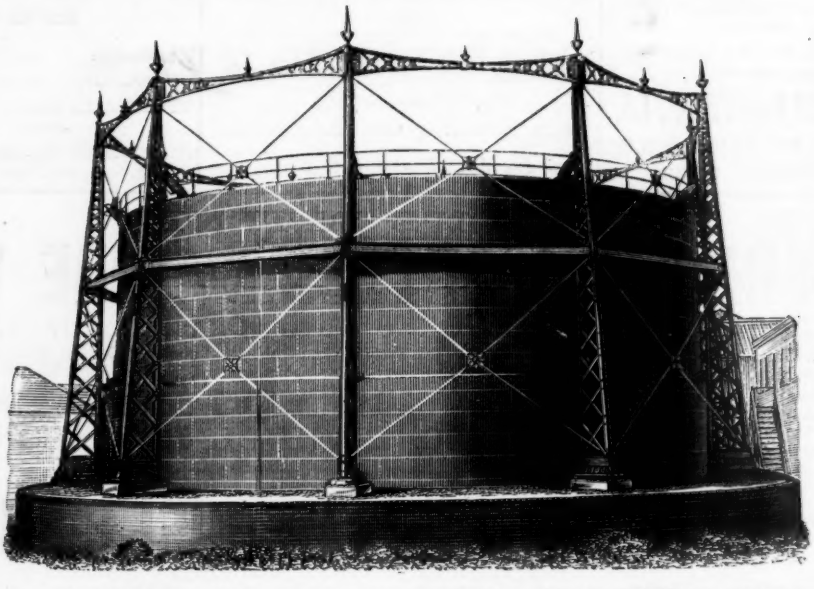

Manufacturers of *PATENT WASHERS, PATENT VALVES for PURIFIERS, &c., GOVERNORS, LAMP COLUMNS, Weighbridges, COKE BREAKERS.*

SOLE MAKERS OF COCKEY AND SMITH'S PATENT SELF-ACTING BYE-PASS VALVES.

Estimates for any description of Gas Plant on application.

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HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

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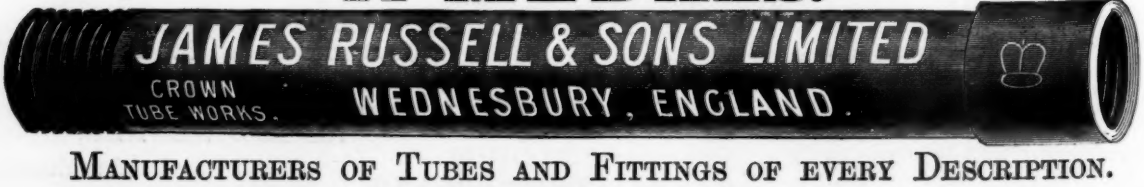

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WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

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GAS APPARATUS

Of every description.

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RETORTS, PURIFIERS, VALVES, SCRUBBERS, CONDENSERS, ETC., ETC

All of the most approved designs.

BOILERS, ENGINES, PUMPS.

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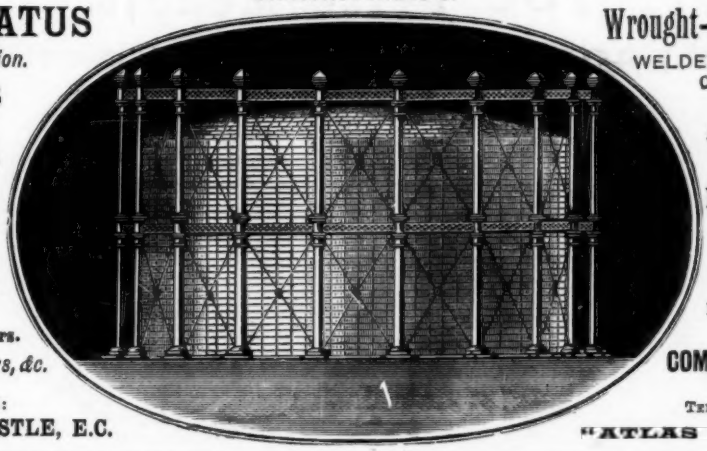

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WELDED AND RIVETTED PIPES OF ALL KINDS OVER 8 INCHES DIA.

SOMERVILLE'S PATENT

RETORT MOUTHPIECES

AND

SELF-SEALING LIDS.

No luting required.

Drawings, Specifications, and Estimates prepared for

COMPLETE GAS PLANTS

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MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

NEWTON, CHAMBERS, & CO., LIMITED,

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MANUFACTURERS OF

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WITH RACK & PINION,

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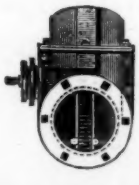
Internal or External SCREWS, of all Sizes.

GASHOLDERS,

AND

Gasholder Tanks.



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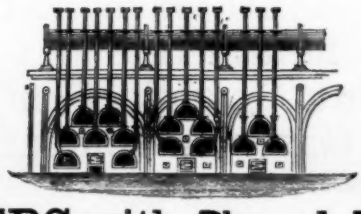
of every description.

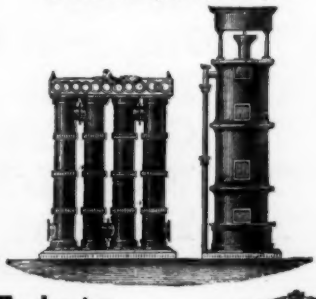
Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.



WROUGHT AND CAST IRON

CONDENSERS, SCRUBBERS, & WASHERS,

TAR AND LIQUOR PUMPS, &c.



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CENTRE VALVES

for working Purifiers.

Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS,

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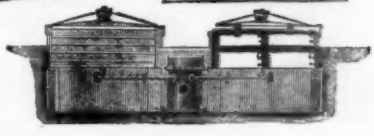

DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

CROSSLEY'S "OTTO" GAS-ENGINE.

100 Prize Medals.

MADE in SIZES
2-Man to 100-HP.

GAS-ENGINES
COMBINED
WITH
PUMPS
FOR
TOWNS SUPPLY,
SEWAGE, &c., &c.

GAS-ENGINES
COMBINED
WITH
AIR COMPRESSORS
FOR THE
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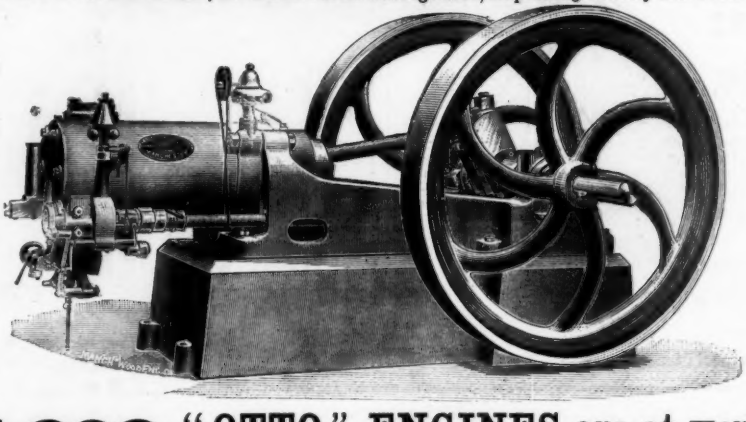
SYSTEM, LUCIGEN
LIGHT, &c.

New 14-H.P. Nominal Size, fitted with Patent Tube Ignition, dispensing entirely with Plates.



MADE in SIZES
2-Man to 100-HP.

VERTICAL
AND
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TYPES.

ENGINES
COMBINED
WITH
HOISTS, PUMPS,
DYNAMOS, &c., &c.

Largely used for
EXHAUSTING,
PUMPING,
COKE CRUSHING,
ELECTRIC LIGHTING,
&c., &c.

Over 31,000 "OTTO" ENGINES are at work.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER,

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MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

CUTLER'S PATENT FREEZING PREVENTER

For Avoiding formation of Ice in Telescopic Gasholder Cups.

SIMPLE, SAFE, EASILY APPLIED, EFFECTIVE.

Adopted by The Gaslight and Coke Company, London.
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The Great Yarmouth Gaslight Company.
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OFFICES:
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WORKS:
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INCORPORATED IN THE LEEDS FIRE-CLAY COMPANY, Ltd.,

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WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.

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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

ESTABLISHED MORE THAN A QUARTER OF A CENTURY

WORKS HUNSLET, LEEDS

LONDON OFFICE: 60, QUEEN VICTORIA STREET E.C.

CLAYTON SON & CO. LTD.

MAKE A SPECIALTY OF GASHOLDERS

AND MAKERS OF GAS PLANT OF EVERY DESCRIPTION.

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JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.

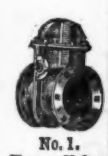
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

Telegrams: "ATLAS SHEFFIELD."

R. DEMPSTER & SONS, Ltd.,

ESTABLISHED 1855.

ROSE MOUNT GAS ENGINEERING WORKS, ELLAND.

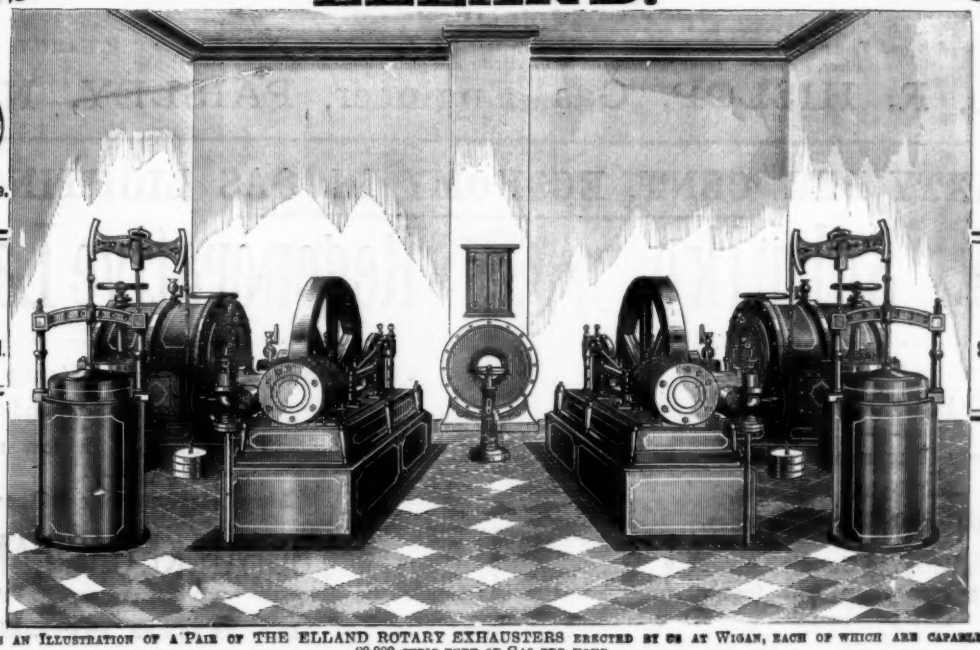


No. 1. Flange Valve.

NO SLIP.

NO OSCILLATION.

No. 3. Screw Valve.



No. 5. Screw Valve.

NO HIGH SPEED.

STEADY GAUGE.

No. 6. Disc Valve

THE ABOVE IS AN ILLUSTRATION OF A PAIR OF THE ELLAND ROTARY EXHAUSTERS ERECTED BY US AT WIGAN, EACH OF WHICH ARE CAPABLE OF PASSING 80,000 CUBIC FEET OF GAS PER HOUR.

Makers of every other description of Gas Plant, including Retorts, Retort Mountings, Condensers, Washers, Tar and Liquor Separators, Scrubbers, Purifiers, Gasholders any size, Patent Centre-Valves, Four-Way Valves, Rack, Screw, and other Valves.

Testimonials and References on Application to

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JOHN HALL & CO.,

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MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

RETORTS CAREFULLY PACKED FOR SHIPMENT.

A STOCK OF DIFFERENT SHAPES ON HAND.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,

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SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

DR. FELDMANN'S APPARATUS

The most successful and approved Apparatus known up to the present time.

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Sole Agents and Manufacturers,

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And to the following Gas Companies and Corporations—

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HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
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DUKINFIELD.	DARWEN.	BOURNEMOUTH.
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SPENT LIMES NO LONGER WASTE PRODUCTS.

Under G. R. HISLOP'S PATENTS

All Spent Limes are most effectually, economically, and continuously recovered, and at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it. Descriptive Pamphlet and Terms from Agents as under.

— REGENERATIVE SETTINGS OF RETORTS. —

Hislop's Patent Producer and Patent Charging Appliances offer advantages which are unapproachable, while in every other detail his Settings are confidently recommended as being the most inexpensive and effective possible.

Illustrated Pamphlet and Terms on application to J. E. FISHER, Stourbridge, Agent for England and Wales; to C. M. HAMILTON, Portland Place, Hamilton, Agent for Scotland and Ireland; and for all other Countries to the Patentee,

Geo. R. HISLOP, Gas Engineer, PAISLEY, N.B.

SIXTY PER CENT. ECONOMY IN GAS LIGHTING.

The Schülke Regenerative Lamp

FOR

DOMESTIC AND EXTERNAL LIGHTING.

The only Regenerative Lamp employing the Common Flat-Flame Burners.

Lamps giving 20-Candle power consume less than four feet of Gas per hour.

PURE WHITE & PERFECTLY STEADY LIGHT,

NOT AFFECTED BY DRAUGHTS.

Suitable for any existing fittings (Brackets or Suspending).

Can be fixed in a few minutes.

May be seen at the Offices of the

SCHÜLKE GAS-LAMP Co.

LIMITED,

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LONDON, W.C.,

Where Price Lists and full particulars may be obtained.

KIRKHAM, HULETT, & CHANDLER'S, LTD.,

NEW PATENT

"STANDARD" WASHER.

EXTRACTS THE WHOLE OF THE AMMONIA

Also a Large Proportion of H_2S and CO_2 from Gas.

The following List comprises the orders received for PATENT "STANDARD" WASHERS constructed according to the Company's latest patent, and Renewals effected by the application of same to old pattern Machines.

NEW PATENT "STANDARD" WASHERS.

	Capacity, cub. ft. per 24 hours.
THE GASLIGHT AND COKE COMPANY—	
Kensal Green	3,000,000
,,	3,000,000
West Ham	3,000,000
Liverpool	3,000,000
Rochdale	3,000,000
Manchester	2,500,000
Glasgow	2,500,000
,,	2,500,000
Leicester	2,250,000
Melbourne	1,500,000
Charlottenburg	1,500,000
Derby	1,500,000
,,	1,000,000
Cambridge	1,000,000
Nice	875,000
Barcelona	875,000
Magdeburg	750,000
Valparaiso	600,000
Halle	600,000
Barry and Cadoxton	500,000
Workington	500,000
Lowestoft	500,000
Erfurt	400,000
St. Chamond	350,000
Atlas Steel Works, Sheffield	250,000
Lille	250,000
Rawmarsh	200,000
Vercelli	200,000
Hitchin	150,000

RENEWALS.

	Capacity, cub. ft. per 24 hours.
THE GASLIGHT AND COKE COMPANY—	
Beckton	2,500,000
,,	1,250,000
Nine Elms (in part)	3,000,000
Shoreditch ,,	2,500,000
Pimlico ,,	2,000,000
Bromley ,,	2,000,000
SOUTH METROPOLITAN GAS COMPANY—	
Vauxhall (in part)	3,000,000
Birmingham ,,	5,000,000
Croydon	1,500,000
Edinburgh	1,500,000
West Ham	1,500,000
Nottingham	1,500,000
Melbourne	1,500,000
,,	1,500,000
Maidstone	1,000,000
Kingston-on-Hull	400,000
Harrow	250,000
Buxton	250,000

For Testimonial from the Chief Engineer of The Gaslight and Coke Company (see last and next week's issue of the "Journal."

Palace Chambers, Bridge Street, Westminster, S.W.

R. & J. DEMPSTER,

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER,

MAKERS AND ERECTORS OF

PATENT COLUMNLESS GASHOLDERS,

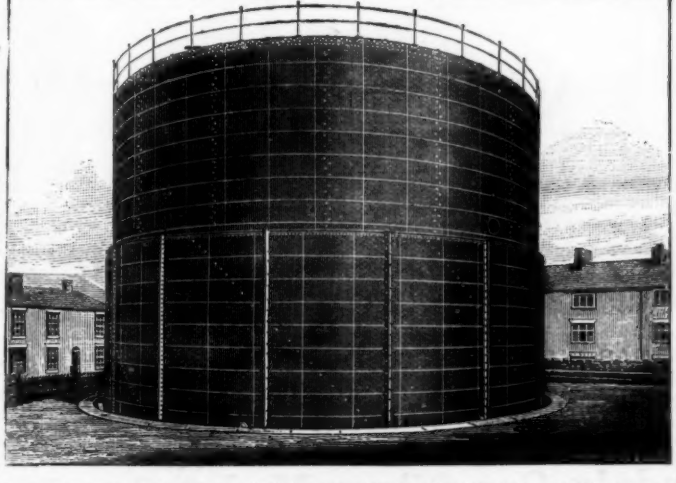
(GADD AND MASON'S PATENT).

Telegraphic Address: "SCRUBBER MANCHESTER."

TOTAL WEIGHT REDUCED
from 30 per cent. to 50 per cent.

TRANSPORT AND ERECTION REDUCED
to the same extent; and in cases where gasholders are shipped abroad to places difficult of access, this represents a very large amount of money.

TANK CONSTRUCTION SIMPLIFIED.
The Tank wall (of whatever construction) is a regular cylinder. There are no piers needed, and all expensive foundation stones for the base of columns or standards are dispensed with.



Two-Lift Gasholder erected at the Gas-Works, Northwich, which has been in continuous work since Jan. 3, 1890, and has been subjected to most severe tests from heavy gales, with perfectly satisfactory results.

COST OF PAINTING SAVED
for the Columns and Girders.

TILTING UTTERLY IMPOSSIBLE;
And as there are fewer parts, there is less liability for the Gasholder to get out of order in working.

STABILITY UNDER WIND PRESSURE
of a Gasholder constructed upon this system is at least equal to, and from experiments and calculations made is far in excess of, that of a Holder of the same dimensions guided by the elaborate guide framing at present in use.

The removal of heavy guide carriages and rollers from the top curbs considerably lowers the centre of gravity of the structure, and dispenses with the extra strength of sheeting necessary to carry these at the points where they are attached to the gasholder.

The plan adapts itself to telescoping to any reasonable extent, and enables very shallow holders or lifts to be employed with perfect stability.

For further particulars and estimates, apply to the above, or to

THE PATENT GASHOLDER SYNDICATE, 504, STOCKPORT ROAD, MANCHESTER.

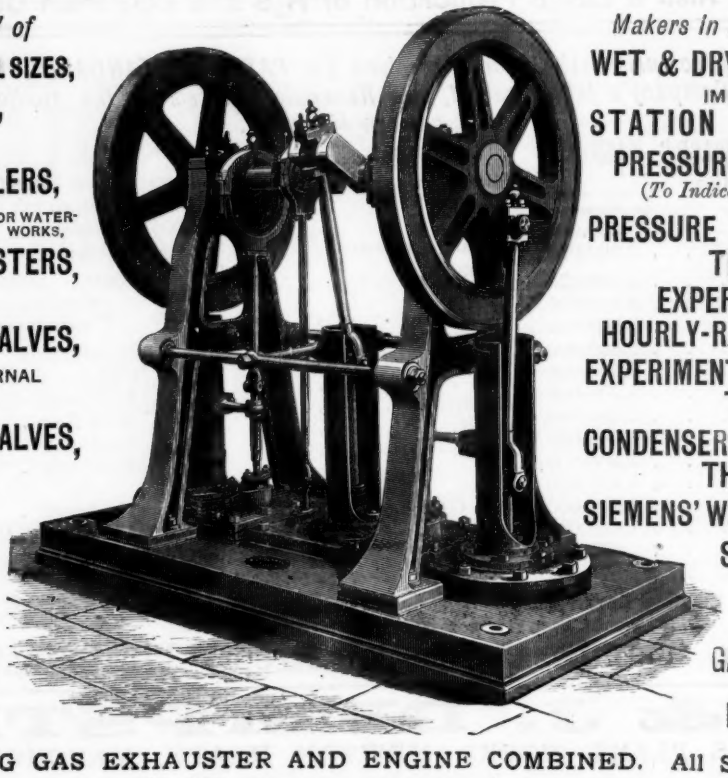
R. LAIDLAW & SON,

GAS AND WATER ENGINEERS.

Manufacturers of **GAS APPARATUS** of every Description.

Makers in GLASGOW of

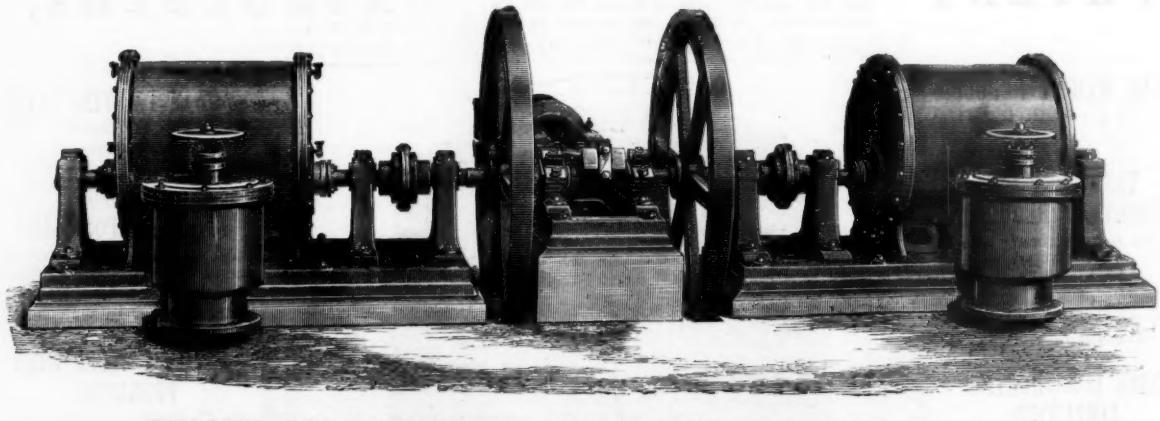
CAST-IRON PIPES, ALL SIZES,
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING ENGINES FOR WATER-WORKS,
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES,
INTERNAL AND EXTERNAL RACK OR SCREW SLIDE VALVES,
CAST-IRON COLUMNS,
BEAMS, GIRDERS, AND WATER-TANKS,
WROUGHT-IRON TUBES, FITTINGS, &c.



Makers in EDINBURGH of

WET & DRY GAS-METERS,
IMPROVED STATION GOVERNORS,
PRESSURE REGISTERS *(To Indicate New Time)*,
PRESSURE GAUGES,
TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS,
EXPERIMENTAL TEST METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS,
And all Kinds of GAS APPARATUS AND FITTINGS, &c.

PUMPING GAS EXHAUSTER AND ENGINE COMBINED. All Sizes.



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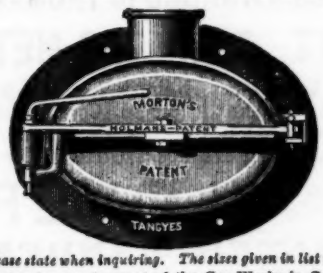
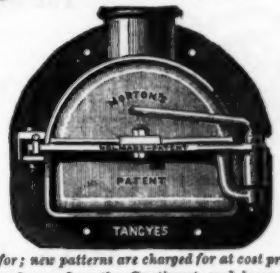
With Anti-Friction CATCHES, and Self-Sustaining CROSS-BARS.





Price of Mouthpieces depends on number required, which please state when inquiring. The sizes given in list we have patterns for; new patterns are charged for at cost price.

These Patent Retort Lids and Fastenings are in extensive use in most of the Gas-Works in Great Britain, America, and on the Continent, and have almost entirely displaced the older method of sealing by a luting of lime or other material. The Lids are made in three forms, D, oval, and round (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these lids are recommended to make their selection, in order to avoid cost of pattern making, delays, &c., &c.

Mouthpieces with Circular Lids for Oval Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
13658	14 ins.	14 × 12 ins.	15 ins.	£0 19 0
4356	14 „	18½ „ 12 „	12½ „	0 19 0
6851	15 „	16 „ 14 „	18 „	1 0 0
3629	15 „	18½ „ 13½ „	14 „	1 0 0
3580	15 „	21 „ 15 „	15 „	1 0 0
6264	16 „	18½ „ 15½ „	15½ „	1 1 0
5210	16 „	20 „ 14 „	15 „	1 1 0
6263	16 „	24 „ 16 „	13½ „	1 1 0
5370	17 „	20 „ 14 „	14 „	1 3 0
6832	17 „	20 „ 14 „	17 „	1 3 0
6183	17 „	20 „ 15 „	15 „	1 3 0
4289	17 „	21 „ 15 „	14 „	1 3 0
5270	17 „	22 „ 14 „	14 „	1 3 0
3631	18 „	18 „ 14 „	20 „	1 5 0
3681	18 „	21 „ 14 „	18½ or 15 „	1 5 0
3554	18 „	21 „ 15 „	14½ „	1 5 0
7957	18 „	22 „ 16 „	14 „	1 5 0
8048*	19 „	25½ „ 15 „	18 „	1 8 6

Mouthpieces with Oval Lids for Oval Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
9800	18 × 14½ ins.	18 × 14½ ins.	15 ins.	£1 5 0
9205	20 „ 12 „	24 „ 14 „	10½ „	1 10 0
10000	20½ „ 14½ „	23½ „ 14½ „	15 „	1 10 0
9680	21 „ 15 „	21 „ 15 „	15 „	1 12 0
10056	21 „ 14½ „	21 „ 14½ „	15½ „	1 12 0
13218	21 „ 15 „	21 „ 15 „	17 „	1 12 0
10514	23½ „ 13½ „	23½ „ 13½ „	13½ „	1 13 0
13766	20 „ 17 „	20 „ 17 „	15½ „	1 15 0
13269	24 „ 15 „	24 „ 15 „	16 „	1 18 0

190

Mouthpieces for Round Retorts.

Diam. .. .. ins.	14	15	16	17	18
Price, Lid and Fittings without Mouthpiece £	0 19 0	1 0 0	1 1 0	1 3 0	1 5 0

Mouthpieces with Circular Lids for D Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
5348	14 ins.	14 × 13 ins.	7 ins.	£0 19 0
3463	15 „	15 „ 13 „	14 „	1 0 0
6678	15 „	15 „ 14 „	12 „	1 0 0
3661	15½ „	15½ „ 13 „	12 „	1 1 0
13052	16 „	16 „ 13 „	18 „	1 1 0
5601	16 „	16 „ 14 „	15 „	1 1 0
6827	16 „	16 „ 14 „	17 „	1 1 0
4494	16 „	16 „ 14 „	14 „	1 1 0
3548	16 „	16 „ 15 „	12½ „	1 1 0
6677	16 „	16½ „ 15½ „	12½ „	1 1 0
6645	16 „	16½ „ 15½ „	12½ „	1 1 0
4434	16 „	17½ „ 14 „	14 „	1 1 0
6469	16 „	18 „ 14 „	15 „	1 1 0
9015	16 „	18 „ 14 „	18½ „	1 1 0
4327	16 „	18 „ 15 „	15½ „	1 1 0
8049*	16 „	18 „ 15 „	17½ „	1 1 0
6137	16 „	20½ „ 13½ „	13½ „	1 1 0
5918	17 „	18 „ 14 „	14 or 17 „	1 3 0
5053	17 „	19½ „ 12 „	14½ „	1 3 0
7548	17 „	20 „ 13 „	15 „	1 3 0
6468	17 „	20 „ 16 „	15½ „	1 3 0
4316B	17 „	21 „ 14 „	14 „	1 3 0
7975	17 „	21 „ 15 „	14½ „	1 3 0
13459	17 „	21½ „ 13½ „	15 „	1 3 0
12990	18 „	18 „ 15 „	15 or 19 „	1 5 0
7135	18 „	18½ „ 15 „	13 „	1 5 0
10221	18 „	18 „ 16 „	12½ „	1 5 0
4506	18 „	20 „ 13 „	19½ „	1 5 0
6470	18 „	20 „ 13 „	15 „	1 5 0
6818	18 „	20 „ 13½ „	17½ „	1 5 0
4083	18 „	20 „ 15 „	16 „	1 5 0
5306	18 „	20½ „ 14 „	13½ „	1 5 0
13295	18 „	20½ „ 14 „	19½ „	1 5 0
7356	18 „	20½ „ 18½ „	13 „	1 5 0
4569	18 „	21 „ 14 „	18 „	1 5 0
3628	18 „	21 „ 15 „	16 „	1 5 0
7640	18 „	22 „ 12½ „	18½ „	1 5 0
7971*	20 „	20 „ 15 „	18 „	1 11 0

*Patterns marked * have Sockets at back to connect to Retorts; all the others are flanged. Patterns marked B have curved bottoms.* 191

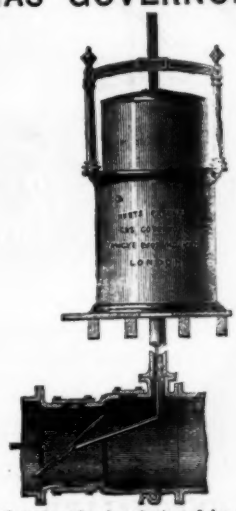
Mouthpieces with D Lids for D Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimension of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
12292	15½ × 13 ins.	15½ × 13 ins.	13 ins.	£1 2 0
9967	16 „ 14 „	16 „ 14 „	15½ „	1 3 0
13574	16½ „ 13½ „	16½ „ 13½ „	13½ „	1 4 0
9899	18 „ 12 „	18 „ 12 „	14 „	1 4 0
12980	16 „ 16 „	16 „ 16 „	18 „	1 6 0
13900	18 „ 13½ „	18 „ 13 „	15 „	1 6 0
9912	18 „ 13½ „	18 „ 13½ „	17 „	1 6 0
9962	18 „ 13½ „	18 „ 13½ „	16 „	1 6 0
10982	18 „ 15½ „	18 „ 14 „	15 „	1 6 0
11098	18 „ 14 „	18 „ 14 „	12 „	1 6 0
9492	20 „ 13 „	20 „ 13 „	15 „	1 10 0
9208	20 „ 13 „	20 „ 13 „	19½ „	1 10 0
10251	20 „ 13 „	20 „ 13 „	15½ „	1 10 0
12964	20 „ 13 „	20 „ 15 „	13½ „	1 10 0
9909	20 „ 13½ „	20 „ 13½ „	17 „	1 10 0
12969	19½ „ 15½ „	19½ „ 15½ „	14 „	1 11 0
13781	20 „ 15 „ Front. / 21 „ 15 „ Back.	21 „ 15 „	15 „	1 11 0
7692	21 „ 15½ „	21 „ 15½ „	16 „	1 11 0
12978	20 „ 16 „	20 „ 16 „	17 „	1 11 0
13252	20 „ 16 „	20 „ 16 „	18 „	1 11 0
13220	21 „ 15 „	21 „ 15 „	17 „	1 11 0
8977	21½ „ 13½ „	21½ „ 13½ „	18½ „	1 11 0
8976	21½ „ 13½ „	21½ „ 13½ „	18½ „	1 12 0
10497	21½ „ 13½ „	21 „ 13½ „	18½ „	1 12 0
8037	21½ „ 13½ „	21½ „ 15½ „	18½ „	1 12 0
9908	21½ „ 13½ „	21½ „ 13½ „	15 „	1 12 0
10404	21½ „ 13½ „	22 „ 14 „	18½ „	1 12 0
12410	21½ „ 13½ „	22 „ 14 „	13 „	1 12 0
13822	21½ „ 13½ „	22 „ 14 „	15 „	1 12 0
10515	22½ „ 12½ „	22½ „ 13½ „	18½ „	1 12 0
7924	24 „ 14 „	24 „ 14 „	15½ „	1 13 0
13807	24 „ 15½ „	24 „ 15½ „	16 „	1 14 0
9015B	25 „ 14 „	25 „ 14 „	12½ „	1 14 0
10932	25 „ 14 „	24 „ 14 „	13½ „	1 15 0
12944B	22 „ 16 „	22 „ 16 „	16 „	1 15 0

Patterns marked B have curved bottoms. 192

HUNT'S PATENT EQUILIBRIUM DIRECT MAIN

GAS GOVERNOR.



In this Governor a throttle valve is substituted for the ordinary suspended cone; all external communication being avoided by placing the lever or radius arm inside the valve chamber upon the disc.

The disc is carried upon steel centres, upon which it is accurately balanced.

4 ins. .. £17 0	8 ins. .. £25 0	14 ins. .. £42 0	20 ins. .. £80 0
5 „ .. 20 0	10 „ .. 33 0	16 „ .. 46 0	24 „ .. 72 0
6 „ .. 22 10	12 „ .. 38 0	18 „ .. 50 0	36 „ .. 130 0

195

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Since then we have not Exhibited for Prizes.

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6th—Prevent jumping or unexpected extinction of the Lights.
7th—May be fixed either above or below the level of the Lights.
8th—Cannot be tampered with without visibly damaging the outer case.
9th—Will last much longer than Wet Meters.
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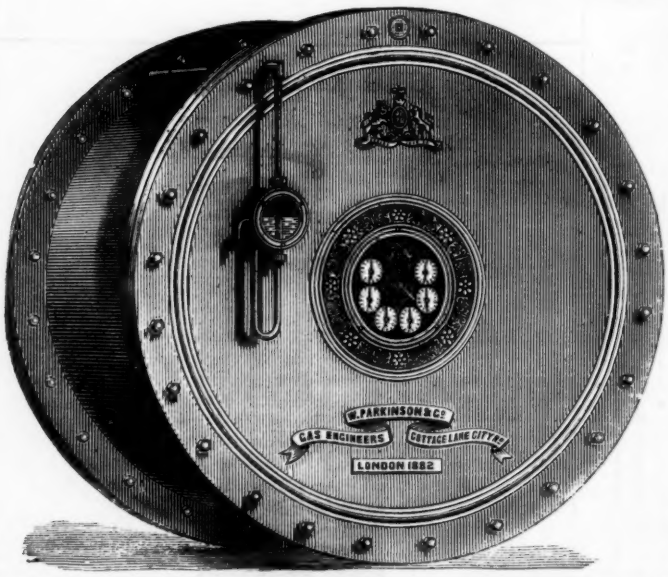

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ROUND METERS as above are kept in Stock in all Sizes ready to send away at the shortest notice. Compact, portable, and very easily fixed. An Improved Overflow Water-line Regulator fitted to every Meter.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 25, 1890.

Profit-Sharing and Trades Unionism.

PROFIT-SHARING schemes continue to interest, and it may also be said to puzzle, students of the relations between capital and labour in these modern times, when everybody is trying his best to answer the riddle of the Sphinx according to his lights. The leaders of the New Unionism never displayed more glaringly their unfitness for the positions they have seized than when they pitted themselves against the South Metropolitan Gas Company's profit-sharing scheme. They set up a claim to be credited with the invention of the eight-hour shift in gas-works, which was not justified; but this is the only benefit they can even pretend to have secured for their supporters, since the intended demand for a rise of 1s. a day in gas workers' wages has perforce been dropped. They would have had ample reason for claiming to have had something to do with the inception of the only profit-sharing scheme that had ever been brought forward by a Gas Company; and if they had welcomed it when it came, and seized upon it as a testimony to their power, they would have earned the gratitude of their supporters, and given a material impulse to the improvement of the conditions of labour everywhere. There would have been some sense and purpose in their proceedings in this event; but they lost their opportunity through sheer blindness. True, they had a principle—the preservation of the sacred right of striking—which was taken away by the profit-sharing scheme; but they made in this regard the blunder of confusing the means with the end. Striking is no good unless something is to be gained by it; and even if it is considered capable of gaining everything, it cannot be regarded as a priceless resource, not to be parted with for any compensation, unless it could be warranted as unfailing and omnipotent. Everybody knows that no such qualities can be ascribed to striking; and as to what was to be gained by the most successful exercise of this power in connection with the gas industry, besides some increase of wages, not even the Gas Workers' Union, in the very heyday of its influence, could explain. We may safely take it, therefore, that this sacred right of striking, which was set by the Unionists above any possible profit-sharing scheme that involved its abrogation, could never, after all, have done more than obtain for those who cherished it so dearly an uncertain rise of wages. Favoured by a peculiar condition of the labour market, it might do this, but only up to an easily ascertained limit; and any such advance of pay extorted by force, might by force have been taken away when the times altered. But suppose the best possible result for it—that wages were thereby forced up, and stayed. Has anybody ever formulated the rate of wages at which the workman may be said to be in possession of the *summum bonum?* Shall it be said that, since the workman is dissatisfied, and not reliable at his work or in his home, at 5s. per day, he will be happy, thrifty, steady, and contented if by striking his pay is forced up to 10s. per day? If this could be said, it would be a good argument for retaining the power of striking at any sacrifice of immediate advantage. But is it not notoriously otherwise? and when wages are high, is not the average wage-earner often seen at his worst? This is because the saying, "Light come, "light go," is especially true of the class of men who live from hand to mouth on weekly or daily wages. So long as the man's interest is limited to his day's pay, the actual sum he receives, whether little or much, is apt to be regarded by him as discharging his liability to his employer, and through the employer to the community at large. The employer is compelled to be more thrifty and prudent than the workman, from the mere fact that his interest in his business is of a more enduring nature; and his liability cannot be discharged at the end of a day. It is practically impossible for him to decide at any time, like the workman, that he has earned enough for one week, and that he can therefore go off "on the loose" until his money is all spent.

If there is anything certain in the teaching of economists, it is that the lasting improvement of the wage-earning class is only to be rendered possible by imbuing the men with a greater sense of responsibility, whereby they may understand that their duty and their advantage do not end with the pocketing of the day's pay. No mere raising of wages will confer this sense of responsibility. If a daily wage were considerable enough to enable the earner to live on chicken and champagne, instead of bread-and-cheese and small beer, and he remained shiftless and uninterested, wherein would he be bettered? It is the great recommendation of any reasonable scheme of profit-sharing that it brings in at once the needed element of continuous interest, and never permits the workman to lose sight of it. It makes the workman a responsible man at the same time that it teaches him his value in the commercial

or industrial organization of which he is a member. Thus the profit-sharing workman is placed on a different plane to that occupied by the irresponsible wage-earner; and it would have been sufficient glory for Trades Unionism if it had claimed this as its triumph over the selfishness and exclusiveness of Capital. The opportunity has been lost, however; and the misled Trades Unionist sees others participating in benefits which might have been his reward, if his leaders had been more solicitous for his welfare than anxious for their own power and influence. There are indications that the blind leaders of the blind—the Press which has backed up the New Unionism and attacked Mr. George Livesey—are coming round to see that the power of striking, which, however successfully it may be exercised, leaves the worker on the same plane as he occupied before, is not everything. The *Pall Mall Gazette*, which had not a good word to say for the South Metropolitan scheme, published last Friday the outlines of a profit-sharing arrangement devised by Mr. Charles Tarling, a member of the London County Council, which, whatever its hypothetical merits, has the same incompatibility with the principles of the New Unionism as that of Mr. Livesey. Nobody can say how Mr. Tarling's scheme will work, until it is tried; but we are curious to understand how it could be adopted by any employer without his being called "unfair," and his men "blacklegs," by the spokesmen of the New Unionism. We observe also that the Manchester Corporation have given notice of their intention to apply for statutory sanction for some scheme for encouraging "thrift" among their employees. Is this to be anything of the nature of an arrangement for giving the officers and servants an interest in the results of their work, or merely a savings-bank and superannuation device? This side of the great labour question is very much to the front just now.

The Middlesbrough Fatality.

DESERVED sympathy will be extended by all his friends and colleagues to Mr. David Terrace, the Engineer and Manager of the Middlesbrough Corporation Gas-Works, in the trouble that has come upon him in respect to the extraordinary explosion which occurred upon his works on the 15th inst., as reported in the JOURNAL last week, resulting in the death of one man, and temporary interruption of the supply of gas to the town. The Coroner's inquest on the unfortunate victim, who died at his post like a faithful servant of the public, has since terminated in a verdict of "Accidental death," to which a string of recommendations to the Gas Committee, intended to prevent the possibility of a recurrence of a similar disaster, was tacked on in the familiar manner of Coroners' juries. We more specially commiserate Mr. Terrace on this deplorable affair, since, although all the trouble of repairing the damage and removing the unpleasant impressions which follow a mishap of this kind falls upon him, he is not to blame, as a new-comer in Middlesbrough, for defective arrangements made in all probability long before his time. Fortunately, Mr. Terrace has a good neighbour in Mr. W. Ford, the Manager of the Stockton Gas-Works, who quickly and heartily responded to his appeal for help; and, between them, the gas connections were re-established in a few hours, and the supply to the town resumed. The circumstances of the accident may be expected to occupy the attention of the Gas Committee for some considerable time; and it is unlikely that the recommendations of the jury will be altogether ignored, although the intention of some of them is superior to the matter. The accident itself is well worthy of the study of those responsible for the design of gas-works buildings and the arrangement of plant. Circumstances govern the disposition of both buildings and plant in many places; so that the ideally desirable is not always attainable, and the designer is generally compelled to make the best of an essentially bad job. It is all very well for a Coroner's jury, or even for a professional critic, to say, after a mishap, that such-and-such an arrangement was dangerous and improper. Hindsight is proverbially easier and better than foresight. We are not disposed to say off-hand that the combination of a water-tank with an enclosed gas-condenser over an engine and exhauster house, which existed at Middlesbrough, was essentially objectionable. Water-tanks are often to be found on the tops of engine-houses, and they may occasionally contain gas-condenser pipes; and there is no reason why calamitous results should follow in such a case. All the same, however, it is impossible to avoid the suspicion that in this Middlesbrough example there must have been some "cheap-and-nasty" work about the building, or it would never have collapsed as the result of a gas explosion in its interior.

The jury were right in remarking that much responsibility attaches to the Middlesbrough Gas Committee for having their works arrangements in such a state that a comparatively trivial explosion entailed the suspension of the gas supply to the town. They were wrong in suggesting that duplication of all apparatus is required to prevent such risk for the future; but the mistake is pardonable in them. What is more to the point is the lesson taught by the explosion, that all gas-works buildings should be made strong enough to withstand the force of expansion of any explosive gaseous mixture which may find its way into them. There is no difficulty about this; for a gas explosion is always more noisy and terrifying than destructive, except to glass and similarly frail structural elements. Gas explosions in private houses seldom do more than blow out windows; and a gaseous mixture cannot be stronger in the gas-works than in a consumer's dwelling. Designers of buildings for gas-works, intended to contain apparatus, ought always to bear in mind the chance of leakage of gas taking place from such apparatus, and of a consequent explosion. These accidents are always possible when gas-works plant is enclosed in a confined space. The only thing to do in such cases is to make the walls strong enough, particularly if they are required to carry anything in an upper storey; and this, as we have already observed, can be ensured without necessarily building them of monumental heaviness. Plenty of window area and efficient ventilation should also be provided for all such buildings, as a matter of course; but, as this Middlesbrough incident shows, these glaringly obvious requirements are occasionally neglected. It can only have been through weakness and closeness of the Middlesbrough engine-house buildings, coupled with a crowded set of gas-connections, that the explosion there had such disastrous results. If the walls had been strong, and sufficient vent for any possible explosive force had been provided, the man Ogden would in all probability have escaped with his life, and the town would not have been plunged in darkness. What has been done cannot now be helped; but it is to be hoped that the Middlesbrough Corporation will do right by the bereaved family of their sacrificed servant, and that their experience will help to discourage cheap, weak, and bad construction in every gas-works in the land.

Return to Uniformity of Price in Brussels.

REFERENCE was made a short time since in the JOURNAL to the remarkable petition of the associated *restaurateurs* of Brussels for a reduction in the price charged to them for gas. Seeing that a Brussels restaurant keeper consumes a large quantity of gas for making as bright as possible his premises, and a good deal of the adjacent street pavement appropriated for the use of his customers, these tradesmen claimed to be justly entitled to the lower rate of charge enjoyed by consumers of gas for trade purposes, and also for gas used in public lighting. It is impossible to deny the force of this argument, since a *restaurateur's* gas bill is as much a charge upon his business as his outlay upon any other means of adding attraction to his establishment; and a number of such places certainly do materially assist in the lighting of any thoroughfare in which they may happen to be situated. The difficulty in admitting pleas of this kind is, of course, the old one of "drawing the line;" for there is a sense in which the gas burnt in every shop and office may be truly described as being for trade purposes, while every glass-fronted shop in which gas is burnt assists in brightening up the street, and may thus be said to contribute to the public lighting. This difficulty has been keenly felt by the administrators of the Brussels gas undertaking; and they have dealt with it by the simple and sweeping measure of abolishing all differential rates. The full significance of this step can only be appreciated by those who remember that Brussels has been the home of very extensive experiments in the popularization of gas through discriminating rates. It was here that the plan of charging 33 per cent. less than the normal rate for gas consumed in the daytime was

introduced; and the same allowance was made for gas consumed for trade purposes, heating, motive power, and public lighting. For some years the price to private consumers of gas in Brussels has been 15c. per cubic metre (3s. 5d. per 1000 cubic feet), while the reduced rate for the classes of consumption already named has been 10c. per cubic metre (2s. 3½d. per 1000 cubic feet), which must be allowed to be exceptionally low for the Continent. In order to put a stop to petitions such as that of the restaurant keepers, however, the Administration have now made a uniform rate of 12c. per cubic metre (2s. 8¾d. per 1000 cubic feet), which seems to fairly satisfy everybody. If the consumer of gas for power is charged a little more, he gets a reduction in his lighting bill, which is generally of even greater importance to him as a business man. This result is calculated to gratify both schools of gas administrators—the uniformitarians and the partisans of differential rates. The former class may point to it as a proof that one price is, after all, the best for the public as well as for the undertaking; while the latter may urge that it is the differential rate that has operated to render a substantial reduction possible. If the uniformitarian agrees that had the price been maintained at one figure all round the reduction now accomplished might have come earlier, the other side may retort that but for the assistance of a differential rate the very profitable departments of day consumption and trade supplies would not have come into existence at all. At any rate, gas seems to be doing very well in Brussels, where it is not handicapped, as in Paris, by usurious dividends and a heavy subsidy to the Municipality.

Smoke Prevention in the City.

THERE has been some talk in the Commission of Sewers of the City of London on the well-worn subject of the smoke nuisance; and the Sanitary Committee of this body have been ordered to report upon the matter. This revival of the question of smoke abatement in London is due to the reported success of the experimental trials of Elliott's smoke-washing apparatus on a vacant piece of ground on the Embankment, the use of which was granted for the purpose by the Commissioners. We have mentioned this apparatus in the JOURNAL on a previous occasion, and now the repetition of the description of it as a smoke-washing device will convey a sufficient idea of its character and quality. Of course, the apparatus is only suitable for factory use, and is most adapted for dealing with the smoke of boiler furnaces, which, on the other hand, may easily be rendered smokeless by the simple expedient of burning coke. Some of the newspapers which noticed the action of the Commissioners of Sewers in the matter were candid enough to confess that it would not be of much use, from the smoke abatement point of view, to deal with factory chimneys alone while domestic fires and bakehouse furnaces are left to pollute the air of London. In point of fact, an observant traveller on any of the elevated lines of railway which pass over the housetops of the low-lying southern portion of the Metropolis from (say) Greenwich to Wandsworth, is more inclined, as he looks at the forest of chimneys, to wonder how the residents in this crowded province of houses can get respirable air at all during the winter months, than to reproach the London atmosphere with the thickness which it occasionally exhibits. The smoke question is a matter of the domestic hearth. If that could be dealt with effectually, the factory development could be easily disposed of.

Manchester District Institution of Gas Engineers.—The eighty-fourth quarterly meeting of this Institution will be held in the Memorial Hall, Albert Square, Manchester, on Saturday next, under the presidency of Mr. W. W. Hutchinson, of Barnsley. According to the programme issued by the Honorary Secretary (Mr. S. S. Mellor, of Northwich), a large amount of interesting technical matter will come before the members after they have disposed of the preliminary business and elected their President for the ensuing year. The paper read by Mr. G. E. Saville at the last meeting, describing his combined washer, tar extractor, and exhaust regulator (see *ante*, p. 496), is to be discussed; and papers are promised by Mr. W. R. Chester, of Nottingham, and Mr. T. Newbigging, C.E.—the former dealing with the "Supply of Steam to Regenerator Furnaces," and the latter on the subject of "Lime Burning." In addition to these, Mr. W. Gadd will give a physical demonstration of the forces acquired to resist wind pressure on a gasholder guided from the base—a matter which will be sure to receive close attention. After the business, the members will, as usual, take tea together at the Star Hotel.

WATER AND SANITARY AFFAIRS.

THE delegates of the Vestries and District Boards who have issued the parliamentary notice for a Bill dealing with the London Water Supply, are taking care to let the world know that the scheme is really theirs. As we gave them credit for it at once, we have nothing to add in that respect. The subject was referred to in the report laid before the County Council last Tuesday by the Special Committee on Water Supply, of which Mr. James Beal is Chairman; and from that document it was made to appear that the Companies were unanimous in declining to submit evidence at an inquiry which the Council proposed to hold on the subject of the water supply. We hardly think this describes the attitude of the Companies with sufficient accuracy. When the inquiry was first proposed, the Companies recognized the position of the Council as authorized by Parliament to conduct such an investigation. But when the Council proceeded to raise the question as to the price to be paid for the transfer of the undertakings, the objection naturally presented itself that, as the Council had no power to purchase, the Companies would be placed in a false position by naming a price. If the Council thought fit to propose terms of purchase, there was a willingness to consider the matter; but then the negotiations—if such they could be called—broke down. The Council proceeded to seek an alliance with the Corporation; and now, forsooth, Mr. James Beal and his Committee say they have come to the conclusion that, "in the absence of the co-operation of the Water Com-"panies, it is not desirable to enter upon an inquiry in "this form." By "this form" is understood an inquiry in which the Companies would not be represented. But we submit that the absence of the Companies is due to the action of the Council. The Committee still desire to "obtain information and prepare evidence, with a view to "its being submitted to any Parliamentary Committee deal-"ing with the subject." Yet the Committee are going to work in a fashion which ensures that the evidence shall be of the *ex parte* nature which they properly assert is the defect of the Corporation inquiry. In respect to legislation, it is resolved that the views of the Council as to any Bills introduced touching the London Water Supply shall be submitted to Parliament. Beyond this the Council cannot go. The initiative rests in other hands.

Since we last addressed our readers, the parliamentary notice for the Corporation Bill, to create a London Water Commission, has made its appearance. As already intimated, it proposes the creation of a new authority or Commission, "representing the interests of the water con-"sumers of the City of London and the County of London "and adjoining boroughs and populous places." "If "thought fit," the Act is to provide for the appointment on the Commission of representatives of the Corporation, the London County Council, and other Local Authorities interested in the water supply of the Metropolis, "or in "the sources of such supply." To this Commission is to be given the power to introduce "an alternative or inde-"pendent water supply," as also to acquire existing waterworks "by agreement, or upon such other terms as may "be authorized." Pending the purchase of the existing works, power is sought to regulate the undertakings of the Companies in respect to the charge for water and the dividends—the latter to be "on a sliding scale or other-"wise;" the declared object being to effect "the equaliza-"tion or uniform adjustment of the price or rate to be charged "or levied" within the area over which the Bill is intended to operate. There are thus two big Bills dealing with the London Water Supply; and it so happens there are two little ones. Of these minor ventures, we mentioned one last week, giving power to the consumer to demand a meter supply. This now appears to emanate from Mr. Blundell Maple. The other little Bill, of which notice has since appeared, while proposing to alter the charge for water, more especially aims at preventing any increase in the charge in consequence of a rise in the rateable value of the premises supplied. Four Bills dealing with the London Water Supply are thus proposed for the session of 1891. We may perhaps mention a fifth, and even a sixth, as just touching the fringe of the great question. Notice is given by the Southwark and Vauxhall Company of a Bill empowering them to raise further capital—a proposal harmonizing with the maxim that threatened men live long, and implying some degree of confidence

that the London Water Companies are not likely to be soon extinguished. There is, however, some risk that hard terms may be imposed when fresh powers are thus sought. The sixth Bill is a very outside measure. It is to empower the Corporation of Croydon to purchase from the Lambeth Water Company that part of their works which relates to the supply of water in South Norwood, Upper Norwood, and the West Wards of the County Borough of Croydon. This is an old question, and it may now be settled.

Reviewing the situation as it affects the London Water Companies, it may be said that they are threatened with a formidable array of opponents in the parliamentary session of next year. Yet the conflict would be much more threatening to the Companies if all their opponents were welded into one, which they are not. The County Council, as a body, has its hands tied behind its back, and is thankful for the help of the Vestries. The Corporation scheme for a Water Commission is clearly at variance with the designs of the County Council, though there is an attempt to make it appear that the Corporation and the Council are fraternizing. The attitude of the authorities in the outer area, as represented at the meeting in the City last week, is important, coupled with the statement made by Sir H. J. Selwin-Ibbetson that the Government scheme of 1880 was never intended to ignore the extra-Metropolitan authorities. This differs from the calculations of the London County Council, and may possibly foreshadow a departure, on the part of the Government, from the views expressed by Mr. Ritchie. We meet with the suggestion that the County Council may supply water in bulk to the authorities in the outer area, and leave them to distribute the supply as they please. But it will not be easy to arrange for this purpose; neither was the idea entertained in the slightest degree at the conference of the authorities from the outer area last week. A writer in the *Pall Mall Gazette*, evidently well informed on the subject, realizes the difficulty created by the outer ring, and says: "The constitution of "the new water authority will almost certainly form a "subject of very strong contention between the Corpora- "tion of the City and the London County Council." "A "keenly contested parliamentary battle" is thus predicted. We are accordingly to look for a three-cornered duel, in which the Companies will find some of the fighting done for them. The weakest point in the Corporation scheme is that it creates a new authority; whereas it is considered that London has too many authorities already. This will incline the balance in favour of the London County Council and yet may not carry sufficient weight to determine the final issue. Some sign from the Government is wanted; and as Parliament meets to-day, perhaps a little more light will soon be thrown on the situation.

Mr. H. Cecil Pelly has just been elected a Director of the West Ham Gas Company, in place of Mr. John Meeson, J.P., who died recently, having been a member of the Board for a period of 22 years.

Mr. W. Mather, who has for many years zealously discharged the secretarial duties in connection with the Stockport Water-Works Company, has now been relieved of his duties by the Directors, who have invited him to a seat on the Board. This position Mr. Mather has accepted; and he will take the place of Managing Director of the Company.

The Incorporated Institution of Gas Engineers.—The statutory meeting of subscribers to the Memorandum of Association of the Incorporated Institution of Gas Engineers was held last Saturday—Mr. G. C. Trewby, the First President of the Institution, in the chair. The proceedings were chiefly formal; but it was decided to give public notification of the fact that the Institution is now definitely founded, and its active existence begun. According to the advertisement which appears in the present issue of the JOURNAL, membership application forms can be obtained of Mr. James L. Chapman, of Harrow, the Secretary *pro tem.* The original subscribers to the resolution for the establishment of the Institution will become members, without election, on signing the necessary form, which they will receive forthwith from the Honorary Secretary. According to the law, a general meeting of the members must be held within four months of registration; but as this will come so early in the year, it will probably be decided to call a meeting within the prescribed time *pro formâ*, and adjourn it to the first general business meeting of the Institution, which will most likely be held during May, in London, when Mr. Trewby will deliver an Inaugural Address, and papers will be read. The attractions of this meeting will be increased by the opportunity that will be given to the members to inspect several stations of The Gaslight and Coke and other Metropolitan Gas Companies which have been largely added to and remodelled during the past year.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1107.)

AT last there is a rift in the clouds, and the prospect is looking brighter. But not before the endurance of an ordeal, perhaps the severest yet experienced. The alarm produced by the Baring revelation at the end of the preceding week had its practical outcome with the opening of the next. Astutely and sedulously fomented by the "bears," the general apprehension reached such a pitch that one would have supposed that everybody and everything was about to smash up. To crown all, it was reported that the banks were going to lock up their cash. Then came the crisis. Stocks of all sorts, good, bad, and indifferent, were wildly offered at almost any price, and failed to get it. For a time they were absolutely unsaleable. But the turning point was not far off. The rescue came through the spirited and judicious action of the Governor of the Bank of England calling together the bank managers, and arranging with them that there should not be any pinch at the next settlement. As it was known that the banks had large cash balances if they only chose to use them, the alarm at once subsided; and perhaps one of the most noteworthy features of this severe crisis is the astonishing rapidity with which the restoration of confidence immediately progressed. The week really closed quite cheerfully; the next settlement is looked forward to without anxiety; and people are already beginning to discuss the next reduction of the Bank rate. While these momentous events were being added to history, the Gas Market remained almost unaffected. One or two trifling reductions in quotation are noted on the list; but, so far as prices actually realized in the course of transactions point, actual values do not appear to have fallen. Gaslight "A" was steadily done throughout the week, and marked 238 on both the opening and closing days. The secured issues were more dealt in than of late, and at figures below the average prices. South Metropolitans and Commercials were extremely quiet, and without special feature. Suburbans and Provincials were absolutely untouched. Of the Foreign division, Imperial Continental was put down 1; but the dealings marked showed good, steady figures. Continental Union, fully paid, also receded 1. Bahia has lost to a similar extent; but San Paulo continues its advance, and is ½ higher. The rest presented no incident calling for remark. The Water Market has been very quiet; but stocks show a much firmer tendency, though quotations have not advanced.

The daily operations were: The Gas Market opened firm on Monday; and all stocks dealt in brought good prices, with the exception of Continental Union. On Tuesday, the average of prices was not quite up to the level of the previous day; but quotations held good, and San Paulo advanced ½. On Wednesday, the tendency to easiness was accentuated by a fall of 1 each in Imperial Continental and Continental Union fully paid; but San Paulo continued to fetch good figures. Thursday's business was restricted, and prices generally were only poor. Friday was much in the same way; but quotations remained unchanged, with the exception of a fall of 1 in Bahia. Saturday was fairly active, and closing prices were favourable.

ELECTRIC LIGHTING MEMORANDA.

The Notices of Applications for Electric Lighting Orders—The Dinner of the Institution of Electrical Engineers—The Prospects of Electric Lighting Companies.

THERE is again a great crop of notices of applications for Provisional Orders under the Electric Lighting Acts; so that next session bids fair to be as busy in this respect as the last. It is a good thing for the Parliamentary Agents, to whom this class of business has proved quite a godsend; and not a bad "line" for the consulting electricians, who now constitute a well-marked order in our highly specialized modern industrial community. After a while, when experience shows the necessity of introducing modifications into the now painfully monotonous Provisional Orders, these will come before the Board of Trade for amendment, and will afford more work for the professional gentlemen; so that whatever may be the prospects of electric lighting as a business, those of consulting electricians in good vogue are not at all bad. Most of this season's applications are from local authorities, who are thus seen to be almost tumbling over one another in their haste to enter upon the possession reserved for them by the Board of Trade. Meanwhile, very few of those authorities who have already obtained electric lighting powers, are displaying any haste in making use of them. Their privileges in this respect include that of delaying for two years before establishing a compulsory supply in the first, or "A" district; and consequently most of them interpret this provision as warranting them in maintaining a watching and waiting attitude for the first year. Some are prolonging their period of suspense to a hazardous length, however; and if they do not bestir themselves soon, their Orders will be in danger of running out.

The Associated Electricians form a goodly company, as may be seen, not without envy of gas engineers, by the newspaper reports of their second annual dinner, which was held on Thursday last under the presidency of Dr. John Hopkinson, F.R.S. It is remarked by *The Times* of the Institution of Electrical

Engineers that, although it is "perhaps the youngest of the many scientific societies in the Metropolis, it has already shown signs of vigorous health, and gives token for the future of unbounded promise." This language of adulation is not altogether free from reproach on the subject of style; but it is sufficiently significant. The electricians certainly know how to keep themselves well in the public eye. Last year they scored heavily by getting Lord Salisbury to attend their dinner and make a speech, which was, of course, reported to the ends of the world. This year they had not quite such a big attraction; but still they did very well with the Postmaster-General, the Attorney-General, the Astronomer-Royal, several Board of Trade officials, and a respectable crop of scientific notables, whose speeches fill a column and a half of *The Times*. It is inevitable that the public should believe that electric lighting is a growing industry when they see such eminent personages content to allow themselves to be identified with it. It will need a strong lift to put the representation of the gas industry, although so much more considerable in a financial sense, fairly on a level with electricity in the public eye.

After what the *Electrical Review* attempted last week by way of proving that central station electric lighting ranks as an investment with gas and water stocks, it is rather odd that the same journal should in another place publish an exposure of the principal London electric lighting companies which cannot be called reassuring to the investor. It is here shown that the London Electric Supply Corporation, with about £654,690 of capital paid up, has approximately 40,000 lamps supplied with current. The same number of lamps are credited to the Metropolitan Electric Supply Company, for £201,583 of paid-up capital. The proportion of capital to lamps varies without any sort of rule; so that at the other end of the scale the St. James's and Pall Mall Company are stated to have lit up 21,000 lamps for £26,000 of capital. The writer agrees with what we have remarked on a previous occasion, that the Pall Mall Company ought to pay a dividend speedily, if there is any money in the business. He commits himself to a curious computation, however, regarding the conditions under which these various companies may be expected to return a good dividend to their shareholders. He assumes that every lamp brings in an average annual rental of 16s.; and that the working expenses, depreciation, &c., may be taken at 50 per cent. of the gross returns. This would leave a profit balance of 8s. per lamp, and would permit the dividend to be calculated according to the capital represented by every such lamp. According to the figures already quoted, the Pall Mall Company have spent only about 24s. per lamp; and therefore they ought to be paying a dividend of something like 33 per cent. But as they happen to be unable to pay anything at all, there is obviously something wrong with the data. At the stated average of 50 per cent. on gross receipts for working expenses, which is given on the authority of two companies, no company can expect to pay a 10 per cent. dividend unless the capital outlay per effective lamp, let at 16s. annual rental, has been kept down to £4. This is little enough, as experience shows. It is full early, however, for the acceptance of general data of this character.

Society of Arts.—The opening meeting of the 137th session of this Society took place last Wednesday, at their rooms in the Adelphi, under the presidency of Sir R. E. Webster, Q.C., M.P., the Chairman of the Council. In the course of his Inaugural Address, the Chairman enumerated some of the principal subjects which have occupied the attention of the Society during the past quarter of a century; among them being the invention of the gas-engine and the development of electric lighting. Dealing with the progress of electrical science, he pointed out that, previous to 1871, there was no place where this could be recorded except in the Transactions of the Society. Going back to 1823 when Mr. Sturgeon, the inventor of the electro-magnet, gave his first description of that apparatus in a paper which was still on the records, he showed that the improved construction of electric lamps and of dynamo machines had from time to time occupied the attention of the members. Referring to the encouragement the Society had given to workers in the domain of science and art, the Chairman alluded to the institution of the Albert Medal in 1864; and among the distinguished men who had been selected to receive this honour, he mentioned the late Sir W. Siemens, to whom was awarded the medal in 1874 for his researches in connection with the laws of heat and the practical application of them to furnaces used in the arts. Passing allusion was made to the lectures given by the Society under the Cantor bequest, to the ordinary meetings, and to the examinations. The services of the Secretary (Sir H. Trueman Wood) were suitably recognized; and reference was made to the honour of knighthood recently conferred upon him. The address closed with a few remarks on the position the Society will hold in the future. The silver medals awarded for papers read during the past session were then distributed; among the recipients being Mr. J. G. Gordon and Mr. W. Whitaker, F.R.S., for their papers on the "Mannesmann Process for Making Seamless Tubes" and "Coal in the South-East of England," both of which were, at the time they were read, noticed in the JOURNAL.

THE PARIS GAS QUESTION—A REACTIONARY PROJECT.

THE student of contemporary systems of gas administration cannot permit himself to overlook the struggles that attend the development of the question of gas supply on the Continent, especially in Paris and Brussels. It appears to the British observer that there is always squabbling in Paris over the price of gas, which he can hardly wonder at when he remembers that the private consumer pays the Company 30c. per cubic metre, which is equivalent to 6s. 9¾d. per 1000 cubic feet, and has done so for 35 years, while the Company have been growing richer every year. The discontent of the private consumer is not appreciably lightened by the knowledge that, since 1870, one-half of the divisible profits of the undertaking remaining after all the capital charges are defrayed and a sum of 11,200,000 frs. set aside for a dividend, is distributed between the shareholders and the municipal treasury. So that, although the Paris Gas Company are very large taxpayers, and also help the Parisian ratepayer in his collective capacity to an extent that even the Manchester City Improvement Committee might envy, the gas consumer is not happy, and therefore does his best to make both the Company and the Municipality uncomfortable. From time to time, as new members are elected to the Municipal Council, this *Question du Gaz* is raked over again; for the new men come to it fresh from meetings of tradesmen's societies and shopkeepers' clubs, in which the exorbitant charges of the Company are alone considered—the subsidy paid by the Company in aid of the public funds being, of course, ignored. So soon as the municipal councillors are made acquainted with the facts of the case, and they learn how hard and fast are the terms of the Gas Company's concession, they flag in their efforts to force a reduction of price, or seek to persuade their constituents that they are keeping the sound of their pledges by promoting actions against the Company which they know must be futile. The Parisian Gas Question is really a very simple one, though from the fuss that is made about it some people might think it difficult. When the terms of the original concession were settled in 1855, the fundamental error was committed of fixing the selling price and leaving the dividend moveable. This was the *fons et origo mali*. The only possibility provided for altering the price was by the cumbrous machinery of a Technical Commission, which might be appointed at any time when it should appear that, through improvements of apparatus, the prime cost of manufacturing gas was reduced. It never seems to have entered the heads of those who represented the State or the public at that time that commercial causes, chiefly connected with increase of consumption, might be more effective in lowering the cost of gas manufacture than improvements of apparatus; and therefore no precaution was taken for securing any portion of such benefit for the consumer. The Company, if they did not perceive it at the time, soon discovered how greatly a concession on these terms would work in their favour in such a growing community as that of the French capital. The terms of the concession were of a very ordinary character for such arrangements at that time; and if applied to the case of a sleepy, stagnant Continental town, the Gas Company would not have had much to congratulate themselves upon. But how mistaken such a concession was for Paris, the event have shown. The dividends and savings of the Paris Gas Company went higher and higher year after year, until the troubles of 1870, when the Company made a fresh contract with the Municipality. They lent the distressed city a large sum of money, and struck a bargain whereby (the price of gas remaining unaltered) they engaged to divide their so-called surplus profits with the Municipality for the remaining term of their concession.

Hence comes the difficulty of satisfying the "bitter cry" of the Parisian consumer for cheap gas. Although the Company have a magnificent revenue, and distribute out of it a dividend that may fairly be called usurious, every franc of it is so tied up that it has appeared impossible to cut into it anywhere for the benefit of the consumer. If an automatic arrangement of any kind had been in force to prevent the swelling of the profits by lowering the price of gas, it would have been all right; but the consumer having been ignored all through, the difficulty is to recognize him without injuriously affecting what have grown to be vested interests. The Municipality, for example, would of course be polite enough to gratify *Messieurs les Electeurs* by raising a cry of "Cheap Gas;" but it carefully gives the Company to understand that, whatever is done, the contributions to the municipal treasury must be forthcoming all the same. The Company, on the other hand, would not cut down the dividend of the shareholders for the sole benefit of the consumers, unless the Municipality would bear part of the sacrifice; and so, under cover of many words, the deadlock has remained to all appearance irremoveable.

The last negotiations with reference to what threatens to be the eternal *Question du Gaz à Paris* were opened on June 2 last with the acceptance by the Municipal Council of a resolution "inviting" the Administration to approach the Gas Company, as if nothing of the same kind had ever happened before, with a view to obtaining a reduction in the price of gas to private consumers. This time the official negotiators, who were represented by M. Alphand, the Director of Public Works in Paris, found the Company not unwilling to discuss the matter with a view to a practical conclusion. To do them justice, the Directors of the Company have never exhibited disinclination

to meet the Municipality upon this question, provided that their legal rights were recognized. They have never hesitated to defend these, however, when the Municipality, in deference to popular clamour, have sought to infringe them. Thus, with regard to the demand for cheaper gas, the Company have been prepared to concede it, provided that they could secure a compensating advantage in the prolongation of the duration of their concession beyond the date at present fixed for its expiration—viz., at the close of 1905—whereby they could relax their onerous sinking-fund requirements. Perhaps we shall not be wrong in surmising that the Directors were specially prepared to talk over their position at this juncture with the representatives of the City, in view of sundry considerations which may have led them to form the opinion that, for their own sake, it would be desirable that gas should be cheapened in Paris. They must perceive that while an immoveable selling price is all very well while there is nothing else to compare with it, yet a "take it or leave it" attitude can hardly be maintained by gas makers who have on the one hand petroleum, and on the other electricity, neither governed by such conditions, but offered freely for what they are worth in the market. Gas burdened with an immoveable price stands, with regard to its rivals, in a different position from that which it would occupy if it could be permitted to meet them on more nearly equal terms; and it would not be surprising if M. Camus and his colleagues had begun to think that a standard price for gas fixed 35 years ago must be growing perilously weak by this time, when it is called upon to sustain the exorbitant dividend which has been piled upon it—with strict legality, it must be admitted, but, as some may hold, with little equity. Be this as it may, M. Alphand met M. Camus, and between them a provisional agreement was concluded, the heads of which were given in last week's JOURNAL (p. 1051).

Since this statement saw the light, the Prefect of the Seine has favoured the Municipal Council with his report on its provisions. It appears that the "artists" of this remarkable work, outside the Gas Company, are M. Alphand and M. Huet; the latter being Inspector-General of Highways, Promenades, and Public Lighting, whose part in the affair was the preparation of a report upon the technical and financial aspects of the convention. The Prefect of the Seine reminds the Municipal Council that the lawsuit against the Company begun in 1883 was a failure, and that the two scientific Commissions since launched at the head of the Company have been fruitless. He tells the Council, therefore, almost in so many words, that the proposition now made to them for a re-arrangement of the terms of the Company's concession is the best that can be hoped for, and wishes them to think twice before rejecting it. The most tempting part of this offer is put in the forefront—the reduction (commencing with the new year) in the price of gas from 30c. to 25c. per cubic metre (from 6s. 9¾d. to 5s. 7¾d. per 1000 cubic feet) for private consumption, and to 20c. per cubic metre (4s. 6½d. per 1000 cubic feet) for motive power. Besides this, the consumers are to receive in actual cash a share representing in gross one-half of the net profits of the concern exceeding a fixed sum of 38,000,000 frs. Moreover, the Company offer to reduce by 2,200,000 frs. the amount of first charge for the shareholders on the annual profits, before dividing the rest with the Municipality. That is to say, that whereas the sum of 11,200,000 frs. is now regarded as a first or preferential dividend charge on the profits, after which the rest is equally divided between the shareholders and the municipal treasury, in future only a sum of 9,000,000 frs. is to be first charged. The immediate effect of this alteration would be to put an additional million francs and upwards into the municipal coffers. In return for these benefits, the Company are to have their concession prolonged for 25 years, and be permitted to engage in the supply of electricity or work any other system of lighting and heating.

Now, it is impossible to deny to this suggested compact a degree of cleverness such as might be expected from the acute men of affairs who have conceived and put it forward. All the same, however, we consider that it is vicious in principle, like the old concession that preceded it, and that its adoption will be beneficial neither to the gas industry nor to the consumers of gas in Paris. It is vicious because it repeats the old error of an unalterable price for gas. The idea of fixing the charge for gas in Paris at 25c. per cubic metre for as far into the future as 1931, is preposterous. The same error vitiates the proposal to divide the surplus profits above 38,000,000 frs. among the consumers. Why this fixed sum, instead of a percentage on the capital invested? Moreover, the method of distribution proposed—to deduct the amount of his calculated share from the next monthly gas bill—is about as bad a way of doing it as could be devised. It simply throws away the money instead of utilizing it, as ought to be done, in reducing the price of gas over the year, or half year, as might be most convenient. As to the increased bribe to the Municipality, the less said the better. They already get far too much; it is the consumer and the shareholder who want relief. To propose to charge 5s. 7¾d. per 1000 cubic feet for Paris gas until 1931 is to weight gas very seriously in face of electricity and oil; and if the Directors of the Gas Company think to gain in a left-handed way by selling electricity what they seem to contemplate losing on gas, they are more short-sighted gentlemen than we take them for. Altogether, we are surprised and disappointed that such a reactionary proposal for dealing with the Paris Gas Question should have been seriously entertained by the Directors; but as to the Municipality, they might be expected to agree to almost anything in consideration of another million francs a year.

Interesting Discovery at Beckton.—During the progress of the excavations for the tank to contain the large gasholder which Messrs. C. and W. Walker have been commissioned to put up at the Beckton works of The Gaslight and Coke Company, in accordance with plans prepared by the Chief Engineer (Mr. G. C. Trewby, M. Inst. C.E.), some interesting relics of a bygone age have been discovered. They consist of a number of flint axes and arrow-heads, a fine specimen of box oak, and some antlers, tusks, and human skulls—all in an excellent state of preservation. They were met with at a depth of 55 feet from the surface. We understand that they will shortly be on view at the offices of the Company in the Horseferry Road.

Liverpool Engineering Society.—At the second ordinary meeting of this Society for the present session—the President (Mr. Hudleston) in the chair—the paper read was on "Water-Pressure Engines," by Mr. John S. Brodie, Assoc. M. Inst. C.E., M. Inst. M.E., of Whitehaven. The author, after a few introductory remarks, dealt with some water-pressure engines which had recently been erected at the Whitehaven Water-Works for the purpose of pumping water to a portion of the town situated at a high level. He stated the conditions under which the engines had to be erected, and the work they had to perform; and then proceeded to describe the engines and pumps in detail, giving statistics of their performance, together with the first cost and the actual expense of working.

The Manufacture of Oxygen.—It is stated by *Industries*, that M. Kassner has recently proposed a method for the preparation of oxygen from atmospheric air, which may eventually be made a continuous one. The process is based on the fact that when calcium plumbate and sodium carbonate are heated together, lead peroxide and calcium carbonate are formed; and on further heating, the peroxide is resolved into litharge and oxygen. After the oxygen ceases to be evolved, the products of the reaction are heated in a current of air to a low temperature, when calcium plumbate is re-formed. In this connection, attention may be directed to a paragraph which appears in another part of the JOURNAL to-day, announcing the registration of Bowman's Oxygen Company, Limited.

Durand's Petroleum Motor.—A recent number of *Industries* contains an illustrated description of a new petroleum motor introduced by Mons. E. Durand, of Paris. It works by means of carburetted air, which it produces itself by the aid of an automatic carburetter. By disconnecting the carburetter, the motor may be employed as an ordinary gas-engine; and in cases where the carburetter is not used, and a supply of gas is not available, it can be worked with petroleum. In order to overcome all irregularity and waste of power, M. Durand has applied a special electrical ignition apparatus actuated by the engine. By this means, an important economy in consumption is claimed, as every charge of the explosive mixture does its full amount of work. The inventor claims for the motor several advantages: (1) That being arranged to produce its own explosive mixture, it is specially adapted for the propulsion of vehicles, launches, &c.; (2) that it is applicable to fire-engines and pumps, &c., on account of its being always ready; (3) that, by the substitution of a valve of simple design for the slide-valve used in most gas-engines, fouling is prevented, and thus the same attention is not required as in other motors.

The Price of Gas and Water in Brussels.—Reference has already been made in the JOURNAL to the proposal which the Gas Committee of the Brussels Municipality have had under consideration, to abolish the existing differential charges for gas, and bring the price to one figure. The Committee have now, we believe, decided to carry out the idea, and charge a uniform rate of 12c. per cubic metre (2s. 8¼d. per 1000 cubic feet) for both day and night gas, instead of 10c. for the former and 15c. for the latter. It is considered that the change will be to the advantage of the consumers, taken all round, inasmuch as the price actually paid averages 14·5c. per cubic metre. The reduction will necessarily affect adversely the municipal budget; but it is proposed to meet the deficit (which is estimated at 400,000 frs., or about £16,000) by making certain financial changes, whereby the expenses of public lighting will be borne by the whole of the taxpayers, instead of, as now, exclusively by the consumers of gas. An immediate consequence of the change will be the necessity for additional works. This eventuality, however, has already been foreseen; and land having a superficial area of about 20 acres, contiguous to the present works, has accordingly been acquired by the Municipality. The buildings and plant will involve an outlay of several million francs; but the investment will, of course, bring a very good revenue into the municipal exchequer. Another proposition—in this instance affecting the water consumers—has been under consideration. At the present time the minimum charge for water used for domestic purposes is 27 frs.; the quantity furnished being not less than 13,000 gallons. It seems that, in a good number of small households, the consumption is much below the supply; and therefore it is proposed to lower the minimum quantity, and consequently the price. If this will not be detrimental to the health of the inhabitants, there cannot be much reason for objecting to the change.

NOTES.

Economy in Heat-Engines.

A curious suggestion for reducing the internal waste of heat in steam-engine cylinders (applicable also, it may be thought, to gas-engines) has been offered by Mr. Robert H. Thurston, M. Am. Soc. C.E., and is published in the Transactions of the Society. Mr. Thurston remarks that great loss of heat is known to occur inside steam-engine cylinders by the alternate absorption of heat by the metallic surfaces of the cylinder heads and piston, and the ejection of this heat later to the condenser, in the case of a condensing engine, or in non-condensing engines into the atmosphere. Many attempts have been made to reduce this loss; as by rendering the internal surfaces less perfect conductors and absorbers of heat, by superheating the entering steam, and by compounding the engine. Mr. Thurston's device for attaining the same object consists in providing an effective non-conducting surface for the internal faces of the steam-engine cylinder, formed integrally with the castings of which the engine is composed. It is well known that ordinary cast iron is largely graphitic, and also that a process of slow oxidation will remove the iron, in part, from the surface so exposed, and leave the carbon in a somewhat compact form, which is held in place by a honeycombed mass of unoxidized metal. This mixture covers the surface of the solid iron to a depth depending on the method and duration of the action of the oxidizing medium. One of the best methods of securing the oxidation of the iron is to subject it to the action of a dilute acid—say, a one-tenth solution of sulphuric acid in water. The idea is to expose the internal parts of the engine to the action of such a solvent for a suitable length of time; thus converting those surfaces into highly carbonized material, which is a comparatively poor conductor of, and has a low capacity for heat. It is impracticable to so treat the rubbing surfaces; but their high polish prevents their taking up much heat. After the non-rubbing, exposed surfaces have been rendered spongy with acid, they are washed, dried, and dressed with linseed oil. Mr. Thurston makes out, from actual test, that by this simple treatment cylinder waste may be reduced by one-half, which in ordinary practice means an economy of from 10 to 20 per cent. of all the steam used. It remains to be shown whether this idea favours the development of a hot-cylinder gas-engine.

The Cheapest Form of Light.

Referring to Professor S. P. Langley's work with his bolometer, a highly sensitive instrument for measuring radiant heat, the *Engineering and Building Record* remarks that, in the ordinary means of artificial lighting, a great deal of energy in the form of heat accompanies the production of the light; and, not being directly utilized, is said to be wasted. In common candle, oil-lamp, and gas flames, this waste ordinarily exceeds 99 per cent. of the total energy developed; and although it is less in the electric light, it is still very much the larger part. The problem, from an economic point of view, is how to produce light with the least amount of heat. In Nature this seems to be effected in certain living organisms, such as the glow-worm or the fire-fly, whose light is accompanied by an evolution of heat inappreciable by scientific instruments, as it certainly was to human sensation, until Professor Langley tested it with his bolometer. Earlier experiments in this direction were referred to in a "Note" published in the JOURNAL for May 27 last (p. 977). The instrument is capable of indicating the heat received by the earth from a star; and by its aid Professor Langley has found that the luminous radiation of the fire-fly's heat per square centimetre of exposed surface is about 0·0004 calorie in 10 seconds. Only a small portion of this heat could reach the bolometer; and that which actually did fall on it in the time mentioned would have raised the temperature of an ordinary mercurial thermometer, having a bulb 1 centimetre in diameter, less than 1-400,000th part of a centigrade degree. Yet even this small amount of heat consisted of two different kinds, requiring to be separated in order to distinguish that due to luminous radiation from the ordinary vital heat of the insect. This separation was accomplished, with the result that the insect's light was accompanied by approximately 1-400th part of the heat ordinarily associated with the radiation of light from common illuminating flames; or, in other words, that Nature lights up the fire-fly at only about 1-400th part of the cost for energy which a candle or gas flame would expend in giving the same light. Professor Langley is hopeful that this distance between the efficiency of artificial and natural means of illumination may be diminished. He says: "There is no reason why we may not hope to yet discover a method of obtaining an enormously greater result than we now do from our present ordinary means of producing light—" to which it may be added that there appears, according to him, to be plenty of room for such improvement. Professor C. Vernon Boys, F.R.S., has made an instrument in which his quartz fibre is a chief component, which is capable of measuring the heat radiated from a candle-flame two miles off. Perhaps he will be able by the same means to profitably investigate the difference of quality between the light of a candle and that of the common glow-worm.

Miss Kelman has been awarded a gold medal for her lectures at the Food and Cookery Exhibition lately held at the Agricultural Hall, Islington.

TECHNICAL RECORD.

THE SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

In the JOURNAL last week we reported the general proceedings at the meeting of the above-named Association on the 13th inst., including Mr. F. Livesey's paper on "A Ready Means of Enriching Coal Gas," and the discussion which took place thereon. We now give the paper read by Mr. H. Smythe, of Maidstone, with a report of the remarks it called forth.

EFFICIENCY IN GAS DISTRIBUTION.

The rapidly increasing use of gas for domestic and trade purposes makes the subject of efficiency in gas distribution one of growing importance; and I propose in this paper to give you the results of my experience and reflections on the matter, trusting that a discussion will follow thereon, which may be of some practical use to us.

I consider that efficient distribution of gas consists in giving a constant supply of gas at all points where it is required, and in doing this with the lowest possible loss of gas. Much has been done by gas engineers to ensure their consumers having all the gas they require, free from interruptions; but it must, I think, be admitted that, owing principally to naphthalene deposits in the pipes, there is still room for improvement in this respect. But the improvement of late years in the matter of unaccounted-for gas has been much more marked, as can be seen by reference to the published accounts of most gas concerns. In "King's Treatise on Coal Gas," which was published about ten years ago, it is stated that the average unaccounted-for gas throughout the country was then about 10 per cent. of the gas made, as against 20 per cent. twenty years previously. I think that the progress since made under this head would justify me in placing the average at the present time at about 5 per cent.; and before long I will not be surprised to find many gas engineers, after allowing say 1 per cent. for condensation of their gas, being able to account for all the rest of it.

Fortunately, in taking steps to remedy the one defect, we shall be going a long way towards remedying the other; for a full supply of gas can only be given and maintained by providing our consumers with amply big meters and services, leading from amply big mains, and in providing these we will be using distributing plant not so liable to cause loss of gas as with plant of insufficient capacity.

Efficient distribution, however, cannot well be considered, without first taking into account that pest of the gas manager, naphthalene. Not more than a partial remedy for the formation of naphthalene in the distributing plant can seem to be provided at the works. We shall consequently find it regularly every winter deposited to a greater or less extent on the interior surfaces of nearly every main and service in our districts. This deposition will not be noticed much in summer. It will have partly dissolved, and found its way into the syphons, and have partly evaporated to the benefit of the gas; and the same thing I believe takes place to a great extent in the mains and apparatus at the works. It is, therefore, necessary (in endeavouring to secure efficiency) to take into account the liability of naphthalene to periodically contract the area of most of the distributing plant, and thereby reduce its capacity. We do not want to have to renew mains and services for many years; so that they should be large enough to supply not only present and future requirements, but allowance should also be made for a diminution of their capacity from depositions of naphthalene. I have for several years had a minimum size of 3 inches for new mains, and 1 inch for new services; but lately I have decided that 4 inches should be the minimum for mains, and for any houses other than cottages not less than 1¼-inch services should be used. For large houses, I have lately used 2 and 3 inch cast-iron services, which I think will prove efficient and durable; and I consider it very important that all mains and services should be laid not less than 2 feet deep in the ground.

With regard to meters, the size should not be less than 5-light where there is a gas-fire or a gas-cooker in use. In fact, it is I think a question of the near future whether smaller meters than this should continue to be fixed. In the matter of unaccounted-for gas, I can testify to the importance of periodically renewing all the consumers' meters. I have at present adopted the plan of renewing all meters after they have been ten years in use; but I think that a shorter period than this might be adopted with much advantage. I am also gradually replacing all wet meters with dry ones; so that, with the exception of a few of the largest size, the meters are all of the latter sort.

Main cocks should have a full clear way, when open, of the same area as the services to which they are fixed; and they should be all tested for soundness before being sent out. I mention this, as I have some difficulty in procuring satisfactory cocks. The public lamps also require consideration, as they are continually before the public, and any deficiency of light from them is much noticed. Here also the services should be large—not less than ¾ inch in diameter up to and including the bend; and the rising pipe ½ inch in diameter to the lamp-cock. The cocks should have a good clear way when open; and they should be fixed inside the lamps close to the regulators. The lamps

TABLE I.—*Stopped Services.*

Year.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	Total for Year.
1883	4	4	5	5	47	39	11	2	15	11	9	4	156
1884	4	4	5	5	19	17	2	..	..	1	1	1	59
1885	..	2	1	12	21	9	6	2	4	2	..	5	65
1886	4	3	6	1	5	9	3	1	1	3	8	4	48
1887	3	..	..	2	8	8	3	2	4	2	4	11	47
1888	10	2	..	32	35	13	6	8	6	7	3	..	122
1889	2	2	1	68	16	56	11	15	4	2	14	11	202
1890	8	1	4	..	4	38	3	7	1	8	8	..	82
Totals. . .	35	18	22	125	155	189	45	37	35	36	47	36	—

TABLE II.—*Make, Sale, and Loss of Gas per Ton of Coal.*

Year.	Make per Ton.	Sale per Ton.	Loss per Ton.	Loss per Cent.
	Cubic Feet.	Cubic Feet.	Cubic Feet.	
1883	10,190	9,378	578	5·68
1884	10,283	9,560	489	4·76
1885	10,553	10,002	356	3·37
1886	10,376	9,874	281	2·72
1887	10,379	9,872	325	3·13
1888	10,807	10,298	337	3·12
1889	11,083	10,619	277	2·49
1890	11,122	10,650	267	2·41

TABLE III.—*Distributing Plant.*

MAINS.			METERS.		
Size of Main.	Yards in Use, 1883.	Yards in Use, 1890.	Size of Meter.	Number in Use, 1883.	Number in Use, 1890.
2-inch.	11,176	6,610	3 lights.	1,239	1,236
3 ,,	6,385	8,035	5 ,,	482	639
4 ,,	10,105	17,059	10 ,,	305	335
6 ,,	6,760	8,171	20 ,,	125	149
8 ,,	1,648	1,648	30 ,,	43	51
10 ,,	108	396	50 ,,	30	41
12 ,,	1,340	1,340	80 ,,	12	22
15 ,,	180	180	100 ,,	6	6
18 ,,	490	490	150 to 250 ,,	2	3
			Private ,,	28	47
Totals. . .	38,192	43,929	Totals. . .	2,272	2,529

themselves should have slight frames, with close-fitting bottoms as well as sides.

Having referred briefly to the principal points which in my opinion go to constitute an efficient distribution of gas, I would add a few general remarks on the subject. In my own experience, nearly all the interruptions to gas supply are caused by naphthalene. Its formation in the mains and services seems to be caused to a great extent by friction; and as the friction of the gas will be greatest in the mains and services which are small in proportion to the amount of gas passed through them, it follows that these small pipes are most liable to be stopped with naphthalene. If this be correct, then a stopped pipe is a pretty certain indication that that pipe is too small for its work. For some years I have noticed that stoppages from naphthalene only occurred in my smallest services, and this repeatedly in some cases; and the evil has been cured by replacing them with larger ones. I have thus largely dispensed with the use of the service cleaner; and I hope in time to dispense entirely with this costly and wasteful means of keeping up a consumer's supply of gas.

In connection with this subject, I give you some working statistics of the Company which I represent—the first of which (Table No. 1) is a record of the stopped services which have occurred in their district during the last eight years. This is interesting as showing that we are liable to have these stoppages throughout the year, but more especially during the last three months of the year. Table No. 2 is a statement of the make, sale, and loss of gas during these eight years. This and the previous table show that stopped services do increase with an increased yield of gas per ton of coal; but their greatly diminished number in the last year also shows that it is possible to remedy the evil in the way set forth in this paper. It should be noted, however, that the large make of gas here shown is not the result of high heats so much as of the regular and even charges of coal which are obtained by the use of West's charging apparatus. The furnaces are direct firing, and the heats are moderate but uniform. This table, with Table No. 3, which is a statement of the mains and meters in use this year and those in use eight years ago, shows that the renewal of this plant has been accompanied with a gradual reduction of unaccounted-for gas to the low figure of 2·41 per cent. of the gas made. I might also add that I consider there is a further margin for the reduction of unaccounted-for gas so long as there are any small old mains and services left in use.

The details of main and service laying, I have not gone into, as these are matters which have often been discussed before; but I might say that I use water-pipes only for mains—the joints being made with lead. The best steam tubing is used for all services. The district is supplied at the works with a gas pressure of 15-10ths during the day and 25-10ths at night. It need hardly be said that stoppage of leaks from mains, services, and meters takes precedence of all other work in the district. The fracture of mains by steam-roller and traction-engine, traffic used to be of frequent occurrence; but the renewal of the small old mains with larger ones, laid at a greater depth, has greatly diminished this source of leakage. Some years ago I did what, on account of the large number of gas cookers and engines now in use, it would be difficult to do now—that is, tested all the suburban mains for soundness. I was rewarded by finding a good deal of leakage from the joints of one of them. More recently when the side-paths of the principal streets were repaved with granolithic paving (which has since made all the mains and services in these streets practically inaccessible), the opportunity was taken to renew most of the services with larger ones.

In conclusion, I might remark that it is now thirteen years since M. Brémond, of the Versailles Gas-Works, conclusively proved that the formation of naphthalene in mains and services could be prevented by desiccating the gas before it left the works; but I have not heard of this being done at any works in this country, and must therefore conclude that the plan is not practicable with us. A large colonial gas undertaking recently tried, by passing the gas through a large condenser after it left the gasholders, to prevent the formation of naphthalene, which at certain seasons of the year caused stopped services to a most serious extent; but I believe this plan has not met with any success. More recently we have heard that the carburetting of gas with oil has not only the desired effect of enriching the gas, but has also prevented the formation of naphthalene, and even dissolved the existing naphthalene in the mains and services. This has, I believe, been proved to be the case at one or two works in London. This last plan looks like an improvement on the one adopted by some engineers, of putting an extra quantity of cannel in their retorts when they have a glut of stopped services. I am myself so strongly of opinion that the only permanent cure for stopped services is by renewing them, that some time ago I asked for, and readily obtained, the consent of my Directors to replace them with larger ones free of charge to the consumers.

Discussion.

The PRESIDENT said the subject of the paper was one in which the members were all interested; and he trusted they would have a valuable discussion. The question of naphthalene was ever with them; and they all experienced difficulty with it. If any of the members had, like Mr. Smythe, found a cure for this troublesome substance, those present would be very glad to hear of it. He suggested that perhaps Mr. Livesey could give the members some information as to whether, when oil was used to enrich gas, it dissolved the naphthalene.

Mr. Frank Livesey (London) said the quantity of vapour required to enrich gas was not sufficient to dissolve naphthalene. He had made an experiment which proved this. He had a 30-inch gas-main in which was a plate-glass window. This was watched nearly every day; and when it was coated with naphthalene—as it often was, to the extent of 3 inches—they dropped some gasoline in. This did not fall straight down, as it was carried along a little by the current of gas; but where it did drop, it dissolved naphthalene for the space of about a foot. Beyond this it practically did nothing. Though there was a very large quantity of gasoline employed for enriching the gas, this showed that they would have to use considerably more to deal with the naphthalene; and therefore it would become very expensive. Mr. Smythe had referred to the French process of desiccating gas; and there was no doubt that there was a great deal in it. If they could take the moisture out of the gas, they would keep the naphthalene in it—that was to say, when condensation of the water in the gas took place, then the naphthalene was deposited. If they could prevent the water condensing out of the gas, he believed the naphthalene would go on and burn. The difficulty was that, with certain kinds of coal, with certain heats, and with irregularities in charging, naphthalene would be produced; and the question was, how to keep it in the gas, and prevent it depositing. He noticed by the tables that Mr. Smythe had a somewhat similar experience to himself in the first cold month of the year. In the line referring to 1889, it would be seen that the highest number of stoppages in services occurred in the month of October—that was, when the cold weather set in. With regard to this question of naphthalene, he had an instance which might be mentioned. At Rotherhithe they had a main which ran underneath one of the dock entrances, and up the other side to a meter which supplied the dock. This meter was nearly always choked with naphthalene. He imagined in winter time, underneath the dock entrance, the temperature would not go down much below 40°, and then the gas would pass on into a temperature of perhaps 32° or lower. This caused the condensation of the naphthalene—the water of the gas was condensed, and at the same time the naphthalene deposited.

The President: Mr. Smythe says with larger services stoppages will be prevented.

Mr. Livesey: Where is he going to draw the line? Why not go on to 3-inch services? I have known a 10-inch main in a district to be blocked up.

Mr. J. Methven (Nine Elms) said they had to congratulate Mr. Smythe upon the results he had achieved at Maidstone. As far as the tables were concerned, there was no doubt whatever that the systematic method he had adopted of enlarging his mains and services had contributed to a diminution of the number of stopped services in the district. On thinking over this matter, it brought back to his recollection—indeed Mr. Smythe mentioned the matter himself—the experiments of M. Brémond on desiccating gas. Mr. Smythe had really desiccated his gas by enlarging his services. He had given the gas a slower rate of travel, and greater facilities for depositing water; and this was one of the reasons why he had met with so much success—in fact, at the point of consumption, the gas was absolutely drier than it would be in a town provided with smaller mains, where the gas had to travel at a greater velocity. Another thing, he worked at a lower pressure in his mains than some of them did. In his (Mr. Methven's) own experience, they worked, at full lighting time, at between 4 and 5 inches pressure. He did not know really that working at a low pressure would facilitate the deposition of moisture; but he felt pretty certain that, the slower the gas travelled in the arterial mains, the more water it was likely to throw down.

Mr. W. Syms (Rochester) said he had tried a little experiment with gas, which proved that drying it was a perfect remedy for the deposition of naphthalene. A few years ago a new post-office was erected at Rochester; and in the front of it were two ornamental lamps, which were to be supplied as part of the public lighting of the city. The people did not like the gas-pipes to run up the outside of the building; and so they were carried into the basement, up the inside of the office, and out through the fresh green brickwork of the wall. The lamps, however, did not burn many nights before there was a stoppage. They were cleared out, and then he thought of the desiccating principle. A couple of tin boxes were made by way of experiment, and one of them was filled with dry unslaked lime, and the other with freshly-calcined chloride of calcium. These appeared to answer the purpose perfectly well; but, in the course of a few weeks, the lime fell down in a fine powder and stopped the flow of gas, so that he adopted the chloride of calcium in both boxes. One of the most troublesome mains he had to deal with was an 8-inch one, 3 miles long; and they had frequently to open it to clear out the naphthalene. He thought this showed that the size of the pipes was not much protection to them.

Mr. Charles Gandon (Lower Sydenham) said that, whenever he heard this question of naphthalene mentioned, he always sat and listened with great interest, in the hope of finding that they had at last discovered a remedy for it; but unfortunately they had not yet reached that happy position. His experience of naphthalene was precisely what Mr. Smythe had stated, and what Mr. Livesey had pointed out—that it occurred just at the commencement of the cold weather. In October this year, they had a very large number of complaints of naphthalene—more than ever before, though they had not been working differently in any way. As to the solubility of naphthalene, he had not been able to find anything to effectually prevent or remove it. During the past summer one of the scrubbers at his works was practically stopped up with naphthalene. They pumped petroleum spirit of two or three qualities into a boiler, and forced the vapour from it with steam into the scrubber. About two barrels of petroleum were used; but when he looked into the scrubber, he found it was in the same condition as when he commenced. He tried sending a different sort of vapour and steam through pipes to the naphthalene; but it remained there almost intact. Therefore he did not think that this was a cure; and he believed that the idea of M. Brémond of drying the gas would be the best remedy they could apply—if it could be applied. There were different ideas as to how naphthalene accumulated. Some said it accumulated in exposed pipes; and Mr. Livesey had illustrated it by the pipe under the dock entrance. But he could say that, in the case of his own house, the supply-pipes ran round two sides and the back of the premises, and were entirely exposed; and yet, for the last fourteen years, they had never been choked. They were, he believed, 1¼-inch pipes; and the number of burners he had was not considerable. Large mains and services were certainly a slight improvement; but they did not keep entirely free from stoppages.

Mr. Norton H. Humphrys (Salisbury) asked Mr. Smythe as to whether he noticed any connection between his stopped services and the quantity of liquid coming from the syphons. The question of the condensation of moisture and the deposition of naphthalene was very interesting; and he thought that, if what had been stated was the case, at the time when there was a stoppage by naphthalene, there should be a greater quantity of water coming from the syphons. In the south-west of England, they enjoyed comparative immunity from naphthalene—that was, where they used Somerset coal; but at most of those places where they were not troubled with naphthalene, they had very little moisture deposited in the syphons. At Salisbury they never had water or naphthalene in the syphons; and he could mention three or four other works where there never was any, or practically no moisture in the syphons. If there was that connection which had been pointed out between naphthalene and moisture, it ought to show itself in the quantity of liquid taken from the syphons.

Mr. J. W. Helps (Croydon) said, in common with Mr. Gandon (his district adjoining that of the Crystal Palace Gas Company), he had had a great deal of trouble with naphthalene. Mr. Smythe appeared to think that enlarging the pipes would be a practical and permanent cure for stoppages by naphthalene, and thought that the friction of the gas passing through small pipes was one of the reasons for its deposition. Very lately he (Mr. Helps) had had a stoppage in a 6-inch main, which conveyed gas to one of the outlying districts, where very little gas was used. This 6-inch main would bear practically the same proportion, according to the amount of gas passing through it, that a 2-inch service had to a house using a dozen lights. This main was often choked up; and he observed that it became blocked underneath a railway arch, where cold winds and draughts would cause it at times to be subjected to great variations of temperature. Part of this arch was covered with galvanized iron sheeting; and from this there was a pipe which carried water to just where the gas-main ran, and the cooling of the latter by the water falling upon it had no doubt a great deal to do with the deposition of the naphthalene. Mr. Gandon had told them how he had tried to remove naphthalene from a scrubber by passing hydrocarbon vapour into it in conjunction with steam. He (Mr. Helps) had had much trouble with a gasholder outlet; and he had tried, among other things, to remedy it by means of steam and naphtha vapour, but it would not answer. Then he tried benzole vapour without steam; and he found it did a great deal more good than when used with steam. Did not this rather point to, and form a proof of the statement which had been made, that the condensation of the moisture caused the deposition of the naphthalene? When the steam was used with the hydrocarbon vapour, the former condensed; and instead of resulting in any clearance of the naphthalene, he should not be surprised if it did not cause a larger quantity to form. If Mr. Gandon had used vapour without the steam in his scrubber, he believed much more improvement would have accrued.

Mr. W. E. Price (Hampton-Wick) said with reference to what Mr. Helps had observed in regard to the outlet of one of his gasholders, he had himself been troubled, during the past year or two, in the same way, both with the inlet and outlet pipes. In the inlet to the gasholder, he had found steam to be very successful in removing stoppages; but in the outlet it had no effect whatever. He noticed this again not many weeks ago, when he steamed an outlet for five hours, and after that time there was no difference whatever in the pressure—it was just as low; but the inlet he had steamed clear in about half an hour. He had known the pressure to drop as much as from 7-10ths to 8-10ths; and he generally steamed for about eight hours before the stoppage would disappear. The secret he believed was this—that, if they were steaming the inlet of a gasholder, they had the gas passing in with it, and the gas was rather warmer than the steam; but with the outlet, where no gas was going out or in, steam had no effect. He had been able to free the outlet by passing gas with the steam.

Mr. C. C. Carpenter (Vauxhall) said that he made naphthalene as a bye-product. (Laughter.) He produced from 30 to

40 tons a year, and sold it. Some imagined that naphthalene had a great deal to do with condensation. But he had one retort-house the gas from which passed across a bridge into a coaling floor, where there was simply a row of windows, and then into a horizontal condenser. Now they had great trouble with naphthalene in this condenser; but there was no sudden cooling there at all—showing that it was not sudden condensation which produced naphthalene. They had naphthalene all through the works; and it was from two mains leading from a gasholder, and running for about ¾ mile, that he obtained the 30 to 40 tons of naphthalene annually. The greater disadvantage of naphthalene was touched upon by Mr. Smythe in his paper. They were feeling very keenly now the competition from electricity and oil. As he had said on a previous occasion, he had this constant experience—of seeing at night time on his way home some shop or house with electric lighting which had not got it the night before. If they put this fact on the one side, and the continual complaints from gas consumers on the other, he thought they would see they were face to face with a very serious question. Indeed, it was more important now that gas managers should sell their gas, and satisfy the consumers' requirements, than to potter about with a lot of theoretical conditions of working on the works themselves—it was far more important to satisfy their consumers first, and give them plenty of gas and light. He was afraid, in the case of some of the larger works, this had not been carried out so much as it should have been. He also remarked that he was an advocate of high-power lamps, of which they had fixed several on Vauxhall Bridge. After being alight for four or five days—sometimes for a fortnight—the supply would become very defective, owing to naphthalene. The man who found the cause of naphthalene, and succeeded in getting rid of it, would, he added, be a great benefactor to gas managers.

Mr. S. W. Durkin (Southampton) observed that naphthalene, like the poor, was always with us. It was an old enemy of his; and he had spoken a good deal about it, and wished he could introduce a method of getting free from it. He might say that exposed pipes sometimes kept very clear of naphthalene. He had a case in mind, where he had a 9-inch main going over a bridge, and he never had a trace of naphthalene in that pipe; but at the entrance to the bridge, where the pipe passed through damp soil, naphthalene accumulated. After it passed over the bridge, and the pipe entered damp soil again, naphthalene appeared; but on the bridge, there was never a speck to be found. With regard to service-pipes, he had no doubt that larger ones would get over the difficulty for a period; but he was afraid that, in process of time, they would become choked. At Southampton he had four mains leading up into the town, and just at certain points they always had a deposition of naphthalene. One was a 12-inch main; and this they only cleared out a few days before, when it was found coated about 1½ inches thick round the inside. This was all thoroughly cleaned out. He did not care about using steam for clearing the pipes; but he took a main off, and washed the naphthalene out with a fire-hose. He also referred to a stoppage he had in the inlet of a gasholder. They sent a jet of water into the inlet-pipe from the crown of the holder, and washed some of the naphthalene down into a syphon. This, however, only partially removed it. With regard to Mr. Smythe's tables, No. 1 showed that in October, 1888, there were 32 choked services; and, in October, 1889, 68. They would invariably find this was the case that, when they had for a time glorious, sunny weather and very cold nights, complaints of stoppages would always arise.

Mr. D. Ford Goddard (Ipswich) said that, discussing this question of naphthalene, was something like saying "them's my sentiments." (Laughter.) They continued repeating their experiences without dealing with the cause. The question to which they might call their attention was, What is really the cause of the formation of naphthalene? Of course, although every gas engineer at times was troubled with naphthalene in parts of his plant or distribution system, there were some who, no doubt, were wonderfully free from it—some would go on for years without suffering seriously from it; while others were considerably troubled, like Mr. Carpenter, who had to take from 30 to 40 tons of this substance from his mains in the course of a year. There must be some explanation of this. Was it to be found in the coal that was used, or in the heats that were employed? Some thought it was accounted for by the temperature in different localities; but as there were those who had spoken from the south, and they knew of managers who were troubled in the same way in the north, that could not be the reason. He considered the question was one upon which it would be well for the Association to institute a series of experiments. He fancied that they often failed in their experiments because each one made them in his own way; and there was no particular point at which they could compare. If a series of experiments could be made on the same lines, and with the object of finding out why there was this large quantity of naphthalene in certain places and under certain conditions, they would be in a much better position to deal with it, and probably do away with it. He was afraid they would not do much good by relating particular experience, and speaking of the evils of naphthalene. Mr. Smythe had pointed out the fact that, by enlarging his service-pipes, he had, in a great degree, remedied the effect of naphthalene; but the question occurred to him whether it was not a remedy which would wear itself out. In a few years these large services would be blocked quite as much as the smaller ones, though not so rapidly. This was not what he should call a satisfactory remedy of the trouble. The difficulty lay deeper than this; and it was discoverable, if they attacked it from the right point of view. He should like to see the Association investigate the matter, and elicit the cause of the formation of naphthalene, and then they could afterwards deal with the question of its cure.

The President thought the speakers had treated the paper from the naphthalene point of view, and had rather gone away from the general subject, which was a very interesting one. Mr. Smythe's tables certainly showed that, by enlarging his mains and services, he had minimized the trouble from naphthalene. Mr. Goddard had pointed out that an experiment might do a great deal in finding out the cause of the formation of naphthalene; but Mr. Smythe had shown that he had successfully done what very few of them could claim to have accomplished in any other way. He thought the paper and tables would bear looking into, and that the members would profit by their having been brought before them.

Mr. Smythe, in replying upon the discussion, said that he would not attempt to answer all the speakers; but he would merely make a few remarks as they occurred to him. As to naphthalene, he felt that his experience differed very much from that of others. Nevertheless there was the fact that he had only naphthalene stoppages in services, and that he had met the difficulty by enlarging them. No doubt these services, in course of time, would require to be enlarged again; and the reason was evident to him. In Maidstone his consumption increased very rapidly—not from an increase in consumers, but from the increase of individual consumption. What did this mean? That the services which they, in the first place, put in to most of the consumers' houses were intended for a small consumption. Now they were consuming from three to five times more gas, by requiring more illumination, and using cooking and heating stoves; and this meant a large increase in the friction in the pipes. This was not an original idea of his. In "King's Treatise on Coal Gas," it was stated that this would cause naphthalene; and M. Brémond mentioned it—in fact, he went further, and said it was not the friction, but the heat produced a chemical reaction in the gas which formed the naphthalene. As to the size of pipes, his experience did not justify him in speaking of stoppages in mains, as he had not had a single one. With regard to Mr. Humphry's remarks, he (Mr. Smythe) could not tell the quantity of liquid taken from his syphons; but he knew a great deal of naphthalene came from them. Of course, he was aware that temperature, as well as friction, played an important part in the formation of naphthalene.

On the motion of the President, seconded by Mr. J. L. Chapman (Harrow), a hearty vote of thanks was passed to Mr. Smythe, which he suitably acknowledged.

Since the meeting, we have received from Mr. Smythe the following additional remarks on the discussion:

The discussion showed that the prevention of naphthalene deposits was a "burning question" with many of the members present; but this was apparently on account of deposits in the mains (both works and district), and not in the services. However, not having any trouble in that way myself, I discussed the subject chiefly as it affected services, of stoppages in which my paper showed I have had considerable experience, and which are well known to occur in some districts by the hundred, and I believe even by the thousand, although, curiously enough, none of the speakers referred to this. I think Mr. Goddard's suggestion, that the cause and cure of naphthalene deposits should form a subject of investigation by the Association, is a good one; and I hope to see them take it up. I consider that inquiry need only be made into the practicability of desiccating gas, and of retaining it in this condition up to the point of combustion, since M. Brémond's experiments have conclusively proved that moisture in the gas is the original cause of the formation of naphthalene; change of temperature being the secondary cause. It does not require any stretch of the imagination to believe in the improvement in quality claimed for desiccated gas. Its retention of the rich hydrocarbon which we call naphthalene, and which with ordinary gas is thrown down at every change of temperature to which it is subjected, would easily account for this. I had hoped that the subject of unaccounted-for gas would have led to some discussion—that, in fact, some member or members would have claimed to have made a better record than mine in this respect, and would have told us how it was done. I claim to have done it in my case principally by renewals of mains and services; and, secondly, by renewals of meters. The unaccounted-for gas of several large undertakings has this year been recorded at a very low figure, notably at Leicester and Carlisle, which are both less than 3 per cent.; and 3·67 per cent. is the figure for nearly the largest provincial gas undertaking in the kingdom—viz., that at Manchester.

Messrs. James M'Kelvie and Co.—In the Journal last week we announced the death of Mr. J. M'Kelvie, the well-known cannel coal merchant of Edinburgh. We have since received an intimation that the business will be continued by his Trustees and Executors (under the style of James M'Kelvie and Co.) with the same management as of late years.

AMERICAN GASLIGHT ASSOCIATION.

Eighteenth Annual Meeting.

[Abridged from the "Official Report" in the *American Gaslight Journal*.]

The Eighteenth Annual Meeting of the above-named Association was held at Savannah, Ga., on the 15th ult. and two following days, under the chairmanship of the President, Mr. EMERSON M'MILLIN, of St. Louis, Mo. The Association was welcomed in person by a powerful Committee comprising the Mayor of Savannah and several other municipal officers. A large number of applicants for membership were elected; and this was followed by the transaction of other business.

The President then proceeded to deliver his Inaugural Address. He first directed attention to the control of the supply of light by municipalities; and showed that the reasons usually advanced in favour of gas-works being operated by representatives of the public apply with equal, and indeed with greater force to railways, tramways, telephones, &c. As to the effects of so-called competition in enabling the purchaser to secure more favourable terms, he questioned whether competition in prices exists to any great extent amongst tradesmen. At any rate, fixed scales of prices usually prevail with regard to bread, groceries, ironmongery, &c.; and he thought it would not be found that these private traders accept a lower return on their investments than were received by gas or electric light companies. The returns from Massachusetts showed that these had paid 5 per cent. dividend for the past year; and he ventured to say that in the businesses supposed to be subject to untrammelled competition, the percentage of profit was double. He questioned whether it could be proved that the municipalities would or could sell to the public at lower prices than incorporated companies operating under municipal franchises, as the preponderance of evidence was the other way. In proof of this, a large number of facts relating to the financial affairs of the Philadelphia Gas Trust, as well as to other towns where the gas supply is in the hands of the local authorities, were quoted. He pointed out that the majority of the water-works of the country are under municipal control, and that the charge for water has remained practically the same during the last 20 years; whereas the average price now charged for gas might safely be put at less than 50 per cent. of that paid 20 years ago.

Going into the causes which militate against the successful and economical administration of corporation gas undertakings, he remarked that the chief factor was that the works were to a greater or less degree under political domination, the baneful influence of which was especially illustrated in connection with the employment of labour. The workmen were voters, or more than that—political workers; and therefore the manager had great difficulty in controlling the size of the pay-sheet. Three plans for the protection of the rights of consumers suggested themselves. The first was a State Gas Commission, such as that which had proved so successful in Massachusetts; the second was the English system of statutory control with limited dividends and a sliding scale of price, which had contributed largely in giving gas to the English public at about half the price paid elsewhere; and the third was the Ohio plan of allowing the City Councils to fix the price of gas. The latter was weak, inasmuch as it did not specifically guarantee freedom from competitive undertakings; though in practice it had that effect. No legislative enactment could be satisfactory that did not afford definite protection against raiders.

Passing on to refer to other illuminants, the President remarked that the use of water gas had become general, and there were few large cities in the country that were not supplied in part with it. Indeed, it was an open question whether the annual production of coal gas in the United States was now as large as that of water gas. This had benefited the coal-gas makers by improving the value of residuals to the extent of 2¼d. to 5d. per 1000 cubic feet of gas manufactured. Fuel gas was not making rapid progress, although some advance was to be recorded—perhaps as much as had occurred in the early history of water gas or the electric light. Little significance need be attached to the fact that fuel gas could not compete with coal in point of price; for it would be used because of its cleanliness and convenience. Electric lighting had advanced rapidly during the past year; and, looking at the fact that 20 years ago there was not in the whole world a light of this kind commercially used, its progress had been remarkable. More than 300 gas companies now employed it—some with the result of increasing dividends, while others appeared to be using it as a means of disbursing surplus profits. It was scarcely necessary to point out that not all of this wonderful success was due to the merits of the electric light. Intelligence, energy, and enterprise in introducing it were to be credited with a great deal; and many officers of gas companies might with profit sit at the feet of some electric lighting managers, and gather crumbs of wisdom. How to popularize gas lighting was still an unsolved problem. Consumers continued to discredit the meter; and too often the index reader and the whole office force also. Some had preferred the electric light, knowing it to be more costly than gas, for the reason that they would know beforehand the extent of their liability. Too often a consumer did not receive proper attention at the gas office; being kept waiting if he called to pay his bill. Some large companies had introduced the plan of having pay-offices throughout the district—perhaps arranging with tradesmen to receive accounts. A town of 100,000 inhabitants might well have ten such stations; and so on in proportion for larger towns.

Turning to the affairs of the Association, attention was directed to the satisfactory increase in the number of members; and then the President spoke strongly and unmistakably in favour of a discontinuance of the practice hitherto prevalent at the meetings, of accepting a banquet or other entertainment from the local gas companies, or from traders. He suggested that newly-elected officers should commence duties on the day following their election, which was usually held on the first day of the meeting, instead of waiting till the next meeting as at present.

At the conclusion of the address, the election of officers for the ensuing year took place; and other business was transacted. The new President is Mr. John P. Harbison, of Hartford, Conn. The reading of papers was then proceeded with.

Mr. E. G. Cowdery, of Milwaukee, commenced with a paper on the "Mismanagement of Gas-Works." While admitting that great advances have been made, and that taken all round the management of gas-works is good, he thought there was still room for improvement. He considered that every gas undertaking should have a responsible manager controlling the whole of its affairs, instead of the responsibility being divided, as at present, between two or more officers. Enlarging on the necessity for selling the best possible article at the lowest figure, he insisted on the importance of being satisfied with fair profits. He believed that if the public were honestly served they would be sure to appreciate it. During the past 15 years the gas companies, realizing the necessity for reducing the cost of the light to the consumer, had worked hard in the way of reducing the price; but he thought the time had now arrived when they might seek to effect the same result in another way, and that was by improving the quality of the gas. It was important to look after every detail, and to know its cost each month; for although the cheapest and best gas was not necessarily a criterion of good management, a great deal depended upon making the most out of local circumstances. A very general mistake was the endeavour to carry out extensions at the least expense—possibly by additions to, or modifications of existing plant. Frequently it happened that a small extra outlay would enable the old apparatus to be replaced by a better kind which could be worked more economically. The same thing was shown by the omission of important parts in erecting new works. He knew of a gas-works supplying a town of 8000 or 10,000 inhabitants, which had no other generating apparatus than a single water-gas cupola. Another mistake was that of not keeping the plant in proper repair, with the desire to show as large a profit as possible. Especially in prosperous times should care be taken to maintain all parts of the plant in good condition, and then if misfortune came the repairs could be allowed to go undone for a year or two without any bad result. Some gas managers, anxious to show a good increase in consumption, or perhaps to cover the inroads of electricity or oil, had resorted to the employment of excessive supply pressure—a course that would in the end defeat its own object. He objected also to allowing more than 1 per cent. of air in the gas, because the air would settle out of the gas when it was in the holder, and result in a heavy and poor-looking light for the first half hour each evening. This was more likely to be noticed and complained of by the public than a uniformly poor gas. Air was necessary for the oxide purifiers, but it should not be admitted except by careful measurement through a meter; and it should be forced in by a steam injector or otherwise, rather than drawn by working the exhauster at a vacuum. With regard to the sale of residuals, the ammonia and tar did not realize half their proper value in many cases; and the spent oxide was thrown away. He therefore suggested that gas companies within a radius of any convenient centre should combine and erect works to utilize the residuals. It was highly necessary for a gas manager to know what his neighbours were doing; and to improve his knowledge by visiting other gas-works, and attending meetings such as that at which they were assembled.

Discussion having been invited, Mr. Littlehales said that some of the difficulties and mistakes alluded to in the paper arose from the fact that the directors of gas undertakings did not come in contact with the consumers, and therefore looked at things entirely from the shareholders' point of view. He agreed with the suggestion that there should be one competent manager over the whole concern. Frequently, in order to economize salaries, the management was entrusted to an incompetent or inexperienced person. Of course, it was possible for any intelligent man to learn the management of gas-works; but while he was doing so, the consumers had to pay for his education. The foreman in each department should have entire control over his men, both as regards their appointment and discharge. He would then take more interest in his work, and get better results than if he were looking after men appointed at the office, over whom he really had but little authority. Another cause of mismanagement, especially in small works, was the employment of a local bricklayer, instead of an experienced retort-setter, to set the retorts. With regard to the meters, they were often allowed to go too long without testing or repair; and a good system in this respect would effect considerable saving. He quite agreed with the necessity

for prompt attention to complaints; and in many cases a call from the superintendent himself would do a great deal. Mr. James Somerville directed attention to the matter of distribution, and to seeing that the mains and services were laid in the best way. He deprecated the practice of doing this work by contract; and agreed with Mr. Littlehales as to the importance of the systematic examination of meters. Mr. Lansden objected to the way in which the admission of air into the gas was alluded to in the paper, as likely to be quoted in support of the oft-repeated assertion that gas companies are in the habit of adulterating the gas with air. This part of the paper probably alluded to the admission of a small percentage of air for the benefit of the oxide in the purifiers.

(*To be continued.*)

THE EFFICIENCY OF GAS-ENGINES.

(*Continued from p.* 896.)

Having given a brief sketch of the theory of the gas-engine, I will now proceed to discuss the results of some of the published trials of engines; giving, where possible, the efficiency in thermal units. It will be necessary to state here, that, in determining the thermal value of a gas, it is usual to take it at the standard temperature of 32° Fahr., and under a pressure of 14·7 lbs. per square inch. As the gas passes to the engine, both its temperature and pressure are somewhat in excess of the standard, in which case the thermal value of the gas in the cylinder of the engine will vary somewhat from that given from calculations at standard temperature and pressure. Where the necessary data can be obtained, this will be allowed for and mentioned.

Of the engines falling under Class I., those of the Lenoir and Hugon type have been tested by M. Tresca, with the following results: Two engines of the type were tested by M. Tresca—the former on Jan. 7 and 8, 1861, and the latter on March 17, 1862. In the former test the engine had a cylinder 7·1 inches in diameter, with a stroke of 4 inches. The mixture of gas and air was admitted into the cylinder during half the stroke, the supply being then cut off and the charge ignited by means of an electric spark; the maximum absolute pressure attained being slightly less than six atmospheres. At a mean speed of 129 revolutions per minnte, the horse power developed at the brake was 0·56; the gas consumption being at the rate of 112 cubic feet per brake horse power per hour. Of the total heat of combustion of the gaseous mixture used, 53 per cent. was carried off by the jacket water. In the second trial, the engine tested had a cylinder 9½ inches in diameter, with a stroke of 4¾ inches. In this case, the period of admission was slightly more than half stroke; and the maximum absolute pressure attained 5·36 atmospheres. At a mean speed of 100 revolutions per minute, the horse power developed at the brake was 0·88; the gas consumption being at the rate of 97 cubic feet per brake horse power per hour. M. Tresca estimated the distribution of heat in this case as follows: Heat converted into work at brake, 4 per cent.; heat carried off by cooling water, 69 per cent.; heat not accounted for, 27 per cent. In comparing the results obtained from these tests with those of more modern engines, due allowance must be made for the size of the engines; the ratio of the surface of the cylinder walls to the volume of the charge being greater than now adopted, with the result that the temperature and pressure of the gases are reduced during expansion, and the heat carried off by the jacket water is increased. From an investigation of the indicator diagrams of this engine, Dr. Slaby finds the value of k for the expansion curve to be 1·38, which brings it slightly below the adiabatic. The other experiment referred to was carried out on Feb. 7, 1866, by M. Tresca, on a Hugon engine having a cylinder 13 inches diameter, with a stroke of 12·7 inches. The mixture of gas and air was admitted into the cylinder for 43 per cent. of the stroke, and the maximum pressure attained five atmospheres. In this case, both the horse power indicated in the cylinder, and that developed at the brake were measured. At a mean speed of 53·01 revolutions per minute, the indicated horse power was 3·55; and the corresponding gas consumption, 53 cubic feet per indicated horse power per hour. The horse power developed on the brake was 2·07, with a consumption of 90·93 cubic feet of gas per brake horse power per hour. A feature in this engine is that, in addition to the water jacket, water is injected into the cylinder, which, being evaporated, cools and lubricates it. Assuming the thermal value of the gas used to be 6000 calories per cubic metre—727 British thermal units per cubic foot (the value given by Tresca)—the heat received by the engine per indicated horse power per hour works out to 35,720 units. The distribution of heat in the engine, as given by M. Tresca, was as follows: Heat turned into work in the cylinder, 7·1 per cent.; heat carried off by evaporation of water in the cylinder, 23·6 per cent.; heat carried off by circulating water, 20·1 per cent.; heat rejected in the exhaust, 10·9 per cent.; heat unaccounted for, 38·3 per cent. This analysis is not by any means so satisfactory as it might be, as the smallness of the amount of heat carried away by the exhaust, and the great extent of the heat unaccounted for, point to the conclusion that a considerable percentage of the gas must have passed away unconsumed in the exhaust. The efficiencies of the engine, calculated from the foregoing data, are: Absolute efficiency, $E = 0{\cdot}71$; theoretical efficiency, $E_t = 0.256$; mechanical efficiency, $E_m = 0{\cdot}58$. Mr. Clerk, in his reply to the discussion on his paper on "The Explosion of Gaseous Mixture," refers to a two hours' test made by him on Dec. 4, 1887, with a Lenoir gas-engine of 1-horse power, having a cylinder 7⅛ inches diameter and 11¾ inches stroke, running at an average speed of 85 revolutions per minute. The power developed in the cylinder, with full load on, was 1·17 indicated horse power; the gas consumption being at the rate of 73·5 cubic feet per indicated horse power per hour. The mixture of gas and air was cut off at 0·4 of the stroke on the in-stroke, and 0·55 of the stroke on the out-stroke of the engine, the maximum temperature of the explosion being 1100° to 1200° C. Of the total heat of the mixture, 60 per cent. was accounted for by the pressure; the remaining 40 per cent. being evolved during expansion. Taking the thermal value of London coal gas at 624 thermal units per cubic foot, the heat actually supplied to the engine per indicated horse power per hour was 45,862 thermal units. The figures work out as follows: Absolute efficiency, 0·055; theoretical efficiency 0·258.

The recorded tests of engines falling under Class II. are by no means numerous; the most exhaustive being that conducted by Professor Thurston, who tested a Brayton gas-engine in 1873. The maximum pressure exerted during the trial was about 75 lbs. per square inch, gradually diminishing to 66 lbs. per square inch at the point of cut-off. The gross indicated horse power of the engine was 8·62, which, allowing 3·62-horse power for the pump, gives 5 indicated horse power net; the mean power developed at the brake being 3·968 horse power. The gas consumption, according to the above figures, averages 55·2 cubic feet per indicated horse power, and 69·3 cubic feet per brake horse power per hour. Taking the thermal value of the gas used by Professor Thurston at 619 British units per cubic foot, we obtain one indicated horse power for an an expenditure of 34,168 thermal units. The efficiencies of this engine work out as follows: Absolute efficiency, 0·075; theoretical efficiency, 0·30; mechanical efficiency, 0·793.

Of the engines falling under Class III. there are two distinct types—viz., those in which the final volume of the gases after expansion is the same as the original volume of the mixture taken into the cylinder, and those in which the final volume is greater than the original volume. Included in the former type are the Otto, Clerk, Beck, Griffin, "Simplex," "Forward," "Ajax," and Fawcett engines, while the Atkinson cycle engine belongs to the latter type. The published results of the trials of the Otto engine are very numerous; the more important being those of Dr. Slaby, of Berlin, Messrs. Brooks and Steward, of Hoboken (U.S.A.), Professor W. G. Adams, at the Crystal Palace Electrical Exhibition, and Professor Kennedy, at the Society of Arts trials of motors for electric lighting.* In the Otto engine, tested by Dr. Slaby in Aug., 1881, the cylinder had a diameter of 6·71 inches, and a stroke of 13·38 inches; the compression space at the end of the cylinder being 291 cubic inches, or 0·6 of the volume displaced by the piston. At a mean speed of 157·7 revolutions per minute, the engine developed 5·04 indicated horse power, and gave 4·4 horse power on the brake, with a total gas consumption, exclusive of the igniting flame, of 142·67 cubic feet, or 146·41 cubic feet, including the igniting flame. This gives 28·3 cubic feet per indicated horse power per hour, and 32·4 cubic feet per brake horse power per hour, neglecting gas used for the igniting flame; or 29·05 cubic feet per hour per indicated horse power, and 33·22 cubic feet per brake horse power, including gas used for igniting flame. Taking the heating value of the gas as 549·7 British thermal units per cubic foot, we obtain one indicated horse power for the expenditure of 15,536·61 thermal units per hour, which was disposed of as follows: Converted into work, 16 per cent.; abstracted by cooling water, 51 per cent.; rejected in exhaust, 31 per cent.; unaccounted for, 2 per cent. From an investigation of the indicator diagram, Dr. Slaby found the value of the coefficient k, for the expansion curve, to be 1·37, which is about the value for adiabatic expansion; thus showing that the heat added after the maximum pressure had been attained was equal to the amount abstracted by the cooling water. The efficiencies of this engine work out as follows: Mechanical efficiency, 0·16; theoretical efficiency, 0·33; absolute efficiency, 0·87.

The next tests referred to were those conducted by Messrs. Brooks and Steward, at the Stevens Institute of Technology, Hoboken. In the engine tested, the cylinder had a diameter of 8·5 inches, and a stroke of 14·01 inches; the volume of the clearance space being 0·61 of the volume displaced by the piston. In one of the most economical trials made under the full working load, with a main speed of 158 revolutions per minute, the power developed in the cylinder was 9·6 indicated horse power; while that given out at the brake was 8·1 horse power. The total gas consumption was at the rate of 235 cubic feet per hour, which gives 24·5 cubic feet per indicated horse power per hour, and 29·1 cubic feet per brake horse power per hour. The heating power of the gas used was 617·1 British thermal units per cubic foot; thus giving an expenditure of 15,118·95 thermal units per indicated horse power per hour, which was disposed of as follows: Converted into work, 17 per cent.; abstracted by cooling water, 52 per cent.; rejected in exhaust, 15·5 per cent.;

* The results arrived at by Messrs. Brooks and Steward will be found in the JOURNAL, Vol. XLIII., pp. 703, 744; and the Society of Arts trials were noticed in Vol. LIII., p. 489.

unaccounted for, 15·5 per cent. In determining the heat rejected in the exhaust, the temperature of the gases was measured by a pyrometer. The value of the heat so rejected is, however, very much lower than that given by other investigators. In order to determine the true mixture used in the cylinder of the engine, not only was the gas used in the engine measured, but the amount of air required was also determined, by passing it through a 300-light meter. In the above test, the ratio of air to gas was found to be 7 : 1. The efficiencies of this engine work out as follows: Absolute efficiency, 0·17; theoretical efficiency, 0·33; mechanical efficiency, 0·843.

A very interesting series of tests were conducted at the Crystal Palace Electrical Exhibition by Professor W. G. Adams, and referred to by him in his address as President of the Institution of Telegraph Engineers and Electricians. The engines tested were of the Otto type, of 2-horse, 12-horse, and 16-horse power nominal. In the 2-horse engine, the cylinder had a diameter of 5·75 inches, with a stroke of 12 inches. At a mean speed of 106·3 revolutions per minute, the power developed in the cylinder of the engine was 3·42-horse power, while that given out at the brake was 2·87-horse power. The total gas consumption was at the rate of 95·8 cubic feet per hour, or 30·9 cubic feet per indicated horse power per hour, and 33·4 cubic feet per brake horse power per hour. Taking the heating value of this gas at 639 British thermal units per cubic foot, we obtain one indicated horse power per hour, at an expenditure of 19,745 thermal units. The efficiencies of the engine are as follows: Absolute efficiency, 0·1446; theoretical efficiency, 0·33; mechanical efficiency 0·84. In the 12-horse power engine, the cylinder had a diameter of 12 inches, with a piston stroke of 16 inches. At a mean speed of 158·7 revolutions per minute, the indicated horse power was 22·56, and the power developed at the brake, 18·31 horse power. The total gas consumption was at the rate of 534·4 cubic feet per hour, or 23·6 cubic feet per indicated horse power per hour, and 29·1 cubic feet per brake horse power per hour. Taking the same value of the heating power of the gas as in the previous case, the expenditure of heat per indicated horse power per hour comes out as 15,080 thermal units. The efficiencies are as follows: Absolute efficiency, 0·1715; theoretical efficiency 0·33; mechanical efficiency 0·81. The 16-horse power engine had a cylinder 13 inches diameter, with a piston stroke of 21 inches. At a mean speed of 151·37 revolutions per minute, the power developed by this engine was 33·6 indicated, and 27·75 brake horse power. The total gas consumption was 841·6 cubic feet per hour, or at the rate of 25·04 cubic feet per indicated, and 30·3 cubic feet per brake horse power per hour. The thermal value per indicated horse power per hour is 16,000 units. The efficiencies work out as follows: Absolute efficiency, 0·1615; theoretical efficiency, 0·33; mechanical efficiency, 0·826. From an analysis of the indicator diagrams obtained from the above engines, Professor Adams found that the curve of the expansion of the heated gases almost coincided with the adiabatic curve; showing that the heat added, after the maximum pressure had been attained, was equal to that abstracted by the cooling water—a point that has already been noticed in discussing previous experiments. He also found that the greatest pressure reached in the larger and smaller engines was practically the same—the compression being the same—but that the time of reaching the maximum pressure was somewhat less in small engines than in large ones.

Possibly the most valuable series of experiments ever conducted on gas-engines are the trials of motors for electric lighting which were undertaken by Dr. John Hopkinson, Professor Kennedy, and Mr. Beauchamp Tower, at the request of the Council of the Society of Arts. Of these trials, which included tests of Otto, Griffin, and Atkinson engines, we will now consider the results obtained from the Otto engine. The tests conducted with this engine, which was of 9-horse power nominal, with a cylinder of 9½ inches in diameter and a stroke of 18 inches, were a six hours' test at full power, and a three hours' test at half power, and a half-hour test running empty. In the full-power test, at a mean speed of 160·1 revolutions per minute, the indicated horse power was 17·12, and the brake horse power 14·74. The mean initial pressure during the trial was 196·9 lbs.; and the mean effective pressure, 67·7 lbs. per square inch. The total gas consumption per hour was 355·3 cubic feet, including 3·5 cubic feet for the igniting flame. This gives 20·55 cubic feet of gas per indicated horse power per hour, and 23·87 cubic feet per brake horse power per hour; or, including the ignition gas, 20·76 cubic feet per indicated horse power per hour, and 24·1 cubic feet per brake horse power per hour. From an analysis of the gas used, the calorific power, at standard temperature and pressure, was 626 thermal units. Correcting this for the temperature and pressure of the gas passing the meter—68·2° Fahr. and 1·34 inches of water, the barometer standing at 14·9 lbs. per square inch—the actual heat supplied to the engine amounts to 12,120 thermal units per indicated horse power per hour, which is made up as follows: Converted into work, 21·2 per cent.; abstracted in cooling water, 43·2 per cent.; rejected in exhaust, 35·6 per cent. From an investigation of the indicator diagrams, the value of the coefficient k, for the compression curve, was found to be 1·380; that for the expansion curve being 1·435. This shows that a very small amount of the heat of compression was carried off by the jacket water, and that the heat abstracted by that water during the expansion was in excess of that added after the maximum pressure had been attained. Taking the clearance space at the end of the cylinder as 40 per cent. of the volume swept by the piston, the efficiencies work out as follows: Absolute efficiency, 0·212; theoretical efficiency, 0·41; mechanical efficiency, 0·86. In the second trial, at half power, the engine ran at a mean speed of 158·8 revolutions per minute, with 41·1 explosions per minute. Under these conditions, the engine indicated 9·73-horse power, and developed 7·41-horse power at the brake. The gas consumption was at the rate of 20·8 cubic feet per indicated horse power per hour, and 27·34 cubic feet per brake; or, including the ignition gas, 21·2 cubic feet per indicated horse power per hour, and 27·77 cubic feet per brake horse power per hour. The heat supplied to the engine was at the rate of 12,275 thermal units per indicated horse power per hour, the expenditure of which was approximately as follows: Converted into work, 20·9 per cent.; abstracted by water jacket, 41·1 per cent.; rejected in exhaust and unaccounted for (by difference) 38·0 per cent. Working under the above-mentioned conditions, the efficiencies of the engine work out as follows: Absolute efficiency, 0·209; theoretical efficiency, 0·41; mechanical efficiency, 0·762.

In the Clerk engine the theory of action will be found to be almost identical with that of the Otto, but the working of the engine is somewhat different, in that in the Clerk engine an impulse is obtained every revolution, as against every alternate revolution in the case of the Otto engine. The tests of this engine, as made by Mr. G. H. Garrett at the Crown Iron Works, Glasgow, in 1885, are as follows: 2-horse power nominal engine. The diameter of the motor cylinder was 5 inches, with a stroke 8 inches, while that of the displaced cylinder was 6 inches, with a 9-inch stroke. At an average speed of 212 revolutions per minute, the net indicated horse power was 3·62, and the power developed at the brake 2·70-horse power. The gas consumption was at the rate of 29·8 cubic feet per indicated horse power per hour, and 40 cubic feet per brake horse power per hour. Taking the heating power of Glasgow gas at 813 British thermal units per cubic feet, one indicated horse power is obtained at an expenditure of 24,227 thermal units. The compression space in these engines is as nearly as possible one-half of the volume swept by the piston from the edge of the exhaust port to the end of its stroke. The efficiencies of the engines are as follows: Absolute efficiency, 0·105; theoretical efficiency, 0·36; mechanical efficiency, 0·755. In the 6-horse power engine, the diameter of the motor cylinder was 7 inches, with a stroke of 12 inches; that of the displacer cylinder being 7½ inches, with a 12-inch stroke. At a mean speed of 146 revolutions per minute, the engine indicated 9·05-horse power net, and developed 7·23-horse power at the brake; the gas consumption being 24·3 cubic feet per indicated horse power per hour and 30·42 cubic feet per brake horse power per hour. Adopting the same value as before for the calorific power of the gas, the expenditure of heat was at the rate of 19,756 thermal units per indicated horse power per hour. The efficiencies work out as follows: Absolute efficiency, 0·129; theoretical efficiency, 0·36; mechanical efficiency, 0·799. In the 12-horse power engine, the diameter of the motor cylinder was 9 inches, and of the displacer cylinder 10 inches, both having a stroke of 20 inches. At a mean speed of 132 revolutions per minute, the engine indicated 27·46-horse power, and developed 23·21-horse power at the brake; the gas consumption per hour being at the rate of 20·39 cubic feet per indicated horse power, and 24·12 cubic feet per brake horse power. The expenditure of heat, adopting the previous value for the calorific power of the gas, was at the rate of 16,495 units per indicated horse power per hour. The efficiencies in this case work out as follows: Absolute efficiency, 0·155; theoretical efficiency, 0·36; mechanical efficiency, 0·845.

The special feature of the Beck engine, which is a three-cycle engine, consists in the taking in and discharging a charge of air before drawing in the charge of explosive mixture. At ordinary powers there is one explosion every three revolutions; the governor being arranged so as to increase or decrease the supply of gas, and so strengthen or dilute the explosive mixture. Only at very low powers does the governor altogether cut off, as well as throttle, the supply of gas. In February, 1888, Professor Kennedy conducted a series of tests on a 4-horse power Beck engine, having a cylinder 7·55 inches in diameter, with a stroke of 15·02 inches. The first test, at a mean speed of 212 revolutions per minute, gave 7·35 indicated horse power and 5·71 brake horse power, for a consumption of 155·7 cubic feet of gas per hour. This is at the rate of 21·18 cubic feet per indicated horse power per hour, and 27·27 cubic feet per brake horse power per hour. The calorific value of the gas used was found, from analysis (after making allowance for its temperature and pressure) to be 585 British thermal units per cubic foot. The total heat expended per indicated horse power per hour is therefore 12,290 thermal units, which is made up as follows: Converted into work, 20·7 per cent.; abstracted by cooling water, 33·6 per cent.; rejected in exhaust, 47·3 per cent. The value of the coefficient k, for the expansion curve, is 1·262, which brings the curve somewhat above the adiabatic; showing that the heat supplied during expansion was in excess of that abstracted by the cooling water. The volume of the clearance space at the end of the cylinder was 0·565 of the volume swept by the piston. The efficiencies are as follows: Absolute efficiency, 0·207; theoretical efficiency, 0·34; mechanical efficiency, 0·779. In the next test made, the engine was run at a mean speed of 168·9

revolutions per minute, giving 6·12 indicated horse power, and developing 4·84-horse power at the brake, for a total consumption of 126·5 cubic feet of gas per hour. This gives 20·67 cubic feet of gas per indicated horse power per hour, and 26·14 cubic feet per brake horse power per hour. The heat supplied to the engine was at the rate of 12,092 thermal units per indicated horse power per hour, the expenditure of which was as follows: Converted into work, 21·1 per cent.; abstracted in cooling water, 33·4 per cent.; rejected in exhaust, 47·1 per cent. The value of the coefficient k, for the expansion curve, is 1·342, which brings the curve slightly above the adiabatic. The efficiencies are as follows: Absolute efficiency, 0·211; theoretical efficiency, 0·34; mechanical efficiency, 0·79.

The Griffin engine is also of the three-cycle type, but its special feature consists in its being made double-acting; the cylinders being closed at each end, and the piston provided with a rod, as in an ordinary steam-engine. There is thus one impulse at each end of the cylinder for every three revolutions. The governing is effected by cutting off the admission of gas whenever the engine is over speed. It can also be worked by throttling the gas supply, as in the case of the Beck engine. The principal tests on this engine are those by Professor Jamieson and Professor Kennedy, at Kilmarnock, and the tests at the Society of Arts trials. In November, 1887, Professor Jamieson made a test of an 8-horse power nominal Griffin engine, having a cylinder 9 inches in diameter, with a stroke of 14 inches. At a mean speed of 183 revolutions per minute, the engine indicated 17·28-horse power, and developed 13·6 horse power at the brake; the gas consumption being at the rate of 333 cubic feet per hour, or 19·27 cubic feet per indicated horse power per hour, and 24·48 cubic feet per brake horse power per hour. From an analysis of the gas used, its calorific value was found to be, after making the necessary corrections for temperature and pressure, 639 British thermal units per cubic foot. This gives the total expenditure of heat per indicated horse power per hour as 12,312 thermal units, distributed as follows: Converted into work, 20·8 per cent.; abstracted by cooling water, 32·4 per cent.; rejected in exhaust and scavenging charge, 46·8 per cent. The value of the coefficient k, for the expansion curve, is 1·382—a value slightly above the adiabatic; showing the heat abstracted by the cooling water to be slightly in excess of that added during expansion. The volume of the clearance space, at the end of the cylinder of this engine, was 0·45 of the volume swept by the piston. The efficiencies therefore become: Absolute efficiency, 0·208; theoretical efficiency, 0·38; mechanical efficiency, 0·787. In February, 1888, Professor Kennedy conducted a series of experiments on an 8-horse power Griffin engine, similar to that tested by Professor Jamieson. Of these experiments, it will only be necessary to refer to those at full power. At a mean speed of 223·8 revolutions per minute, the engine indicated 17·46-horse power net, and developed 14·24-horse power at the brake. The total amount of gas used per hour was 352·2 cubic feet, which gives the gas used per indicated horse power per hour as 18·92 cubic feet, and per brake horse power as 23·58 cubic feet. From the analysis, the calorific value of the gas, after making needful corrections for temperature and pressure, was found to be 639 British thermal units per cubic foot. This gives the amount of heat supplied to the engine per indicated horse power per hour as 12,098 units, the expenditure of which was as follows: Converted into work, 21·2 per cent.; abstracted by cooling water, 39·7 per cent.; rejected in exhaust, &c., 43·1 per cent. The value for the coefficient k, for the mean expansion curve, is 1·373, which is very close to that of the adiabatic. The efficiencies work out as follows: Absolute efficiency 0·229; theoretical efficiency, 0·38; mechanical efficiency, 0·856.

The Griffin engine tested at the Society of Arts trials was of 8-horse power nominal, with a cylinder 9·02 inches in diameter and 14-inch stroke, with a piston-rod 1·75 inches in diameter at one end. The tests I purpose referring to are those at full and at half power. In the former, or full-power test, with the engine running at a mean speed of 198·1 revolutions per minute, it indicated 15·47-horse power, and developed 12·51-horse power at the brake. The total gas consumption during the trial was 357·3 cubic feet per hour, including 7·1 cubic feet for the igniting flame. This gives a mean consumption per hour of 22·64 cubic feet per indicated horse power, and 28 cubic feet per brake horse power, neglecting the gas required for ignition; or 23·10 cubic feet per indicated horse power, and 28·56 cubic feet per brake horse power, including the ignition gas. The calorific power of the gas used was, at standard temperature and pressure, 624 British thermal units. Correcting this for the temperature and pressure of the gas passing the meter—67° Fahr. and 14·91 lbs. per square inch—the actual heat supplied to the engine was 13,380 thermal units per indicated horse power per hour, made up as follows: Converted into work, 19·2 per cent; abstracted by cooling water, 35·2 per cent.; rejected in exhaust, &c., 45·6 per cent. The expansion curve in this case was slightly above the adiabatic; the value of k being 1·350. The efficiencies of this engine are as follows: Absolute efficiency, 0·192; theoretical efficiency, 0·38; mechanical efficiency, 0·809. In the second trial, at half power, the engine developed at a mean speed of 201·8 revolutions per minute, 10·23 indicated horse power, and gave out 6·30 horse power at the brake. The total gas consumption was 234·5 cubic feet per hour, including 5·8 feet for the igniting flame. This gives a mean consumption of 22·35 cubic feet per indicated horse power, and 36·30 cubic feet per brake horse power, neglecting the gas required for the igniting flame; or 22·92 cubic feet per indicated horse power, and 37·20 cubic feet per brake horse power, including the ignition gas. The heat supplied to the engine was at the rate of 13,208 thermal units per indicated horse power per hour, distributed as follows: Converted into work, 19·4 per cent.; abstracted by cooling water 32·5 per cent.; rejected in exhaust, &c., 48·1 per cent. The efficiencies work out as follows: Absolute efficiency, 0·194; theoretical efficiency, 0·38; mechanical efficiency, 0·616.

(To be continued.)

REGISTER OF PATENTS.

Generating Gas for Heating and other Purposes.—Dixon, D., of Bayswater. No. 16,795; Oct. 24, 1889. [8d.]

This invention consists in the combination of certain of the processes usually employed in generating producer and water gas, in such a way that a mixture of these two products in certain proportions can be generated uniformly and continuously in one apparatus.

To effect this, there is constructed a reversing producer or generator, with two combustion chambers communicating with each other, either at the top or bottom, so that the forced reversing draught or blast may go up one chamber and down the other alternately, or down one chamber and up the other alternately, as the case may be; the reversing-valves for the admission of the forced initial draught or blast into each chamber alternately, as well as those for the outlet of the gas, being in the first case placed at the bottom of the chambers, and in the other case at the top. At or near the opening between the two chambers, a jet of steam is admitted for a purpose to be afterwards described. When introduced at the top, as in the "up-draught" producer, it may be made to assist the downward draught in one chamber by sucking or forcing the gases ascending in the other chamber sidewise or downwards through a throat—the direction of the jet being made reversible. In the case of the "down-draught" producer, the steam may be introduced by hollow grate-bars, and may be made to assist the upward draught in each chamber alternately. In the "up-draught" producer, it is preferred to dispense with grate-bars at the bottom of each chamber—substituting therefor narrow piers or diaphragms of refractory material, separated by narrow spaces, and spanning a flue into which each of the spaces opens. This flue, which is made deep enough to serve as an ash-pit, runs through the side of the producer at the bottom, where it is fitted with a gas-tight door for removing the ashes. It also communicates with the reversing air-blast and gas-outlet valves to the main gas-flue; and it serves alternately as a channel for the inlet of the blast and the outlet of the gas. In the "down-draught" producer, the diaphragms and spaces run through under the chambers and over a central flue, which serves as an ash-pit for both, and is fitted with a gas-tight door at the end for removing the ashes. Hollow grate-bars are placed in each of the spaces between the diaphragms, through which the steam is admitted; or the steam may be introduced by a pipe and jets in the central flue, or otherwise. Each chamber is provided with a gas-tight door opposite the ends of the diaphragms and spaces, having in it covered poking-holes opposite each of the spaces. The gas off-take valves may be made with hollow trumpet-shaped stems, for the purpose of conveying the blast into the producer when the corresponding off-takes are closed. A Körting steam blower may also be attached to each, or they may be connected with a fan or other suitable blower; and each chamber may be surmounted by a charging-hopper closed by a bell and cover, or otherwise arranged so as to prevent the escape of gas when the fresh fuel is being dumped. In the "up-draught" producer the stem of the bell may be hollow, to allow a steam-pipe to pass through and be lowered into position to supply the jet of steam downwards, through the throat, which is, in this case, formed on the top of the chamber.

The action of the apparatus is as follows: The fuel in each chamber, including a fresh supply, which is dumped after reversing, is alternately raised to incandescence by the blast; the producer gas generated thereby, and the hydrocarbons distilled from the freshly-charged coal, passing through the incandescent fuel in the other chamber on its way to the gas-main. As much steam as the cooling fuel will convert into water gas during the heating up of the other chamber is admitted; and the product mingles continuously with the producer gas. In addition to converting the steam into carbonic oxide and hydrogen, the incandescent fuel reduces the carbonic acid (which always exists in quantity in the producer gas) to carbonic oxide, and converts the tarry and sooty hydrocarbons into permanent gases. A product is thus obtained having a higher percentage of heating material than ordinary producer gas, and free from tar and soot. When it is desirable to use a portion of the producer gas for generating steam or for other purposes, it can be taken off before it reaches the point where the steam is mingled with it (off-takes being arranged in a suitable way); or the charging apparatus may be suitably connected with a gas-main, and serve as outlets.

Charging Inclined Retorts.—Morris, F., of Brentford. No. 19,763; Dec. 9, 1889. [6d.]

This invention relates to the charging of inclined retorts built with the charging mouths in the centre of the bed; and it consists of constructing them with a division between the two sloping retorts, so as to avoid the loss of gases which occurs in the process of recharging.

Fig. 1 is a plan of the top lids or covers B, on one of which is attached a handle C with a lever D bolted to a pin F on the cover. The lever is fixed to the hinge E; and when the cover is closed, the end of the lever fits into a catch G. On pulling the handle towards the edge of the bed-plate A on the hinge side, the catch is released and the cover raised. Fig. 2 is a longitudinal section of the two sloping retorts I, with the bed-plate and the ring bolted together. A portion of one of the tops of the retort is shown in elevation; and both are imbedded in brickwork.

In charging retorts on the Y or A plan, says the patentee, great inconvenience and danger from flame can be avoided by separating the

Fig. 1.

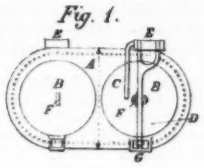
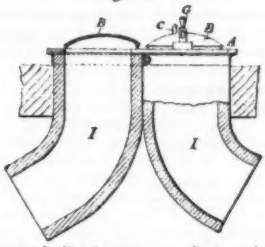


Fig. 2.



two retorts by a central diaphragm, so that each charge is distinct; and the essential point of the present invention is such "separation of each retort into two distinct retorts, so that when coals are dropped in one side the lid is closed, and prevents the gas interfering with the next charge."

Gas-Engines.—Debouteville, E. F. D., and Malandin, P. C. L., of Fontaine-le-Bourg, France. No. 14,900; Sept. 20, 1890. [8d.]

This invention relates to means for regulating the action of gas-engines, combined with an improved arrangement of the piston, whereby more perfect expansion is obtained.

In employing gas-engines for certain purposes, it is necessary to obviate the irregularities, however slight, that are caused when the admission changes from full to nothing, or *vice versâ*. With this object, it has already been proposed to weaken the gaseous mixture by varying the proportion of gas admitted; but the chief disadvantage of this method is that it is not practicable except by varying the proportion of gas within very narrow limits, and producing gaseous mixture less easily ignited. By means of the present invention, however, these disadvantages are obviated; the gaseous mixture is allowed to retain its full proportion of gas, so that its ignition is certain; and the amount of mixture admitted into the cylinder is regulated according as the speed of the motor rises above the normal rate. These arrangements are completed by regulating the air-pump in a peculiar manner, and by increasing the length of the piston so as to obtain, in addition, a more perfect expansion of the gas and a more complete exhaust or discharge of the products of combustion.

APPLICATIONS FOR LETTERS PATENT.

17,745.—Cooke, T., "Improvements in the method of setting clay retorts for the manufacture of coal gas, to be called 'The Bristol retort setting.'" Nov. 5.

17,820.—Gubbins, R. R., "Improvements in retorts." Nov. 5.

17,879.—Tully, W., and Corbett, J., "Improved means for regulating or controlling the flow of gas to or through gas burners or pipes." Nov. 6.

17,921.—Eitle, C., "Machine for charging gas-retorts." Nov. 7.

17,945.—Henry, W., "Improvements in gas-stoves." Nov. 7.

18,047.—Unsworth and Richmond, Limited, and Unsworth, W., "Improvements in material for use in incandescent gas-fires." Nov. 10.

18,115.—Pointon, S., "Improvements in apparatus connected with the manufacture of gas for heating purposes." Nov. 11.

18,134.—Welch, W., "Improvements in and relating to burners for the use of gas and other vapours." Nov. 11.

18,165.—Winterflood, J., "Improvements in gas-pressure regulators." Nov. 11.

18,208.—Skinner, S., "A self-generating gas-iron for domestic purposes." Nov. 12.

18,230.—Vestrant, L. van, and Graham, M., "Improvements in the construction of shoots for charging inclined gas-retorts." Nov. 12.

18,239.—Simon, R., "Improvements in or connected with gas-engines." Nov. 12.

18,281.—Ford, H. H., "Improvements in apparatus for giving a sonorous indication of pressure, quantity, or temperature of fluids or liquids, applicable to gas, steam, and other gauges." Nov. 13.

18,310.—Welch, W. H. I., "Improvements in overhead or roof lamps." Nov. 13.

18,313.—Ruler, W., and Mœller, J., "An improvement in incandescent gas-burners." Nov. 13.

18,353.—Grimston, G. S., "Gas motors for tramcars." Nov. 14.

18,360.—Guyon, H., and Metai, L., "Improvements in the manufacture of combustible gas for heating, lighting, and generating motive power." Nov. 14.

18,398.—Falk, S., "Improvements in and applicable to lamps." Nov. 14.

18,401.—Griffin, S., "Improvements in apparatus for igniting the charge in petroleum and other hydrocarbon motors." Nov. 11.

Large Station Meters for Beckton.—The Gaslight and Coke Company have just placed an order with Messrs. W. Parkinson and Co., of Cottage Lane Works, City Road, London, for two station meters, each to pass 250,000 cubic feet per hour. These are the largest meters yet supplied to the Beckton works; and, with those previously erected (all of which have been made by the same firm), they will make a total of 14, having an aggregate capacity of 2,380,000 cubic feet per hour, or upwards of 57 millions per day.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Gadd and Mason Gasholder.

Sir,—In bringing this controversy to a close, it may be of interest to record the opinion of one of the ablest Professors of Engineering in the country, and the author of several standard works on engineering science. After reading the controversy, he wrote me a few days since as follows:—"*I sympathize with you in your endeavour to convince Mr. Gadd of his errors; but I fear your labour will be in vain, as his knowledge of elementary mechanics appears to be too limited for any argument to reach him. The new design may be advantageous under certain circumstances, but the inventor is quite at sea in his theories.*" I may mention that the Professor is a Member of the Institution of Civil Engineers and a Member of the Institution of Mechanical Engineers. Another eminent Engineer writes as follows: "*You have, as everyone who has read the articles must see, dealt with the questions scientifically, while Mr. Gadd has only made manifest his ignorance.*" The foregoing are but two of many assurances I have had (not only English but foreign) of the justice of my "Criticism." But Mr. Gadd may still accept the shelter which was offered him, with the very best of intentions, in its concluding paragraphs.

My "Criticism" of Mr. Gadd's Gas Institute paper remains unshaken in the slightest degree. The minutest facts therein have not been disproved; whereas, on the other hand, they have been more than established. It is an undeniable fact that Mr. Gadd has represented his gasholder as being vastly stronger than it is. In my last article it was proved conclusively that *the strains are at least eight times greater than he represented them to be*—after making every possible allowance for his excuse about the wind pressure. His treatment of what he terms the diagonal strain on the top curb, the errors of which I thoroughly exposed, he has not defended; and then the practical questions dealt with in my "Criticism" (and to which I beg your readers to refer) have scarcely been alluded to, much less disproved.

As regards the advantages to be derived from the discussion by Mr. Gadd, I do not hesitate to say that he will find the concluding part of my "Rejoinder" exceedingly useful to him, if he only knows how to apply it; for it determines theoretically and *practically* the correct forces acting directly upon the bottom roller axles in his holder. The method is applicable to any size gasholder; and, as far as I know, it is the only plain and complete example of it to be found. This may, I hope, in some degree compensate him for his defeat.

There are but few points I need notice in Mr. Gadd's last two communications on this subject—

(1) The untenableness of his position appears to be dawning upon him; for we read, "Mr. Cripps has brought, at last, his total forces at the sides exactly equivalent to my own." This—as all who have had any experience in discussing with Mr. Gadd will know—is tantamount to an acknowledgment of defeat on his part.

(2) The experiments Mr. Gadd refers to exactly prove *my case*, when correctly interpreted.

(3) As for "doing my worst to hinder the sale of his gasholder," I need only reply that, if such had been my intention, I should not have restricted my observations solely to the points raised by Mr. Gadd in his paper, but should have treated of much more serious objections than have yet been made. The imputation is unjust, and would give one the impression that Mr. Gadd claims an exclusive right to propound erroneous theories, unopposed.

I have given it as my opinion that for *small* gasholders (such as the one at Northwich) the holder is perfectly *safe* when properly designed and constructed; but that for *large* ones it is not so. Its safety is not to be gleaned, however, from *looking at it*. Neither does its safety prove its *durability*, even for small holders.

Those who have followed this discussion will, I am sure, sympathize with me in declining to enter into further controversy with Mr. Gadd. If error is propounded, I may expose it; but I must decline to discuss it with him.

F. S. Cripps.

Sutton, Nov. 20, 1890.

Tar Extractor.

Sir,—I notice in last Tuesday's Journal an illustrated description of a so-called tar extractor, patented by Messrs. Kirkham, Hulett, and Chandler. This is an identical copy of a washer which has been in use at the Stafford Gas-Works for at least twelve years, and was, I understand, designed by a Mr. Pugh, who for many years was foreman at these works.

It is an efficient washer for extracting ammonia, but not a good apparatus for eliminating tar from gas; the bottom cups into which the nozzles on the lower sides of the plate dip being liable to become choked up with tarry matter, and the washer then throws back-pressure. Further it has the disadvantage of being difficult to clean out; for the removal of each cup takes a considerable time.

I may add that it is only fair to mention that Messrs. Kirkham, Hulett, and Chandler were unaware, before patenting, that a similar washer was already in use.

J. F. Bell.

Gas-Works, Stafford, Nov. 21, 1890.

Mr. Clark's Remarks at the Southern District Meeting.

Sir,—In your issue of the 18th inst., in reporting the proceedings at the meeting of the Southern District Association of Gas Managers, I am credited with having said "that we had not a burner to test gas up to 17 candles." What I did say was, "that we had not a test-burner suitable for testing gas above (not about) 17 sperm candles."

Frank W. Clark.

Nov. 22, 1890.

[We would point out that the words first quoted by our correspondent are not as they appeared in our issue last week; nor are the concluding words those he used on the occasion referred to. We give his letter, however, to prevent any misunderstanding.—Ed. J. G. L.]

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, Nov. 21.

(*Before Mr. Justice* CHITTY.)

The Gaslight and Coke Company v. The South Metropolitan Gas Company. The Award in the Arbitration Proceedings.

To-day a motion by the plaintiffs came before his Lordship for an order upon the defendants to pay two sums of £5804 15s. 2d. and £388 16s. 10d. found to be due to them under the award made by Mr. H. E. Jones, on July 25 last, in the arbitration proceedings arising out of the dispute between the parties as to the boundaries of their respective districts. The circumstances under which the question originated have been fully reported in the JOURNAL.

Sir HORACE DAVEY, Q.C. (with whom was Mr. DANCKWERTS), appeared in support of the motion.

Justice CHITTY: Is this opposed?

Mr. MARK KNOWLES (for the defendants) said he opposed the motion so far as the payment of interest was concerned. The only question in dispute was whether, in a case like the present, interest ought to be, or could be, allowed.

Sir H. DAVEY said his Lordship would remember that the action was brought by The Gaslight and Coke Company against the South Metropolitan Gas Company to restrain that Company from infringing on the statutory area of the plaintiffs. Mr. Justice Kekewich and the Court of Appeal, feeling themselves constrained by authorities, dismissed the action; but their decision was reversed by the House of Lords, who granted an injunction, and sent the case back with a direction to cause an inquiry to be made as to the damages sustained by the plaintiff Company. This came before his Lordship, and he directed the inquiry; and the matter was referred to Mr. H. E. Jones. Having read the award, the learned Counsel said that the question between his learned friend and himself was whether the smaller amount named therein should be included.

Justice CHITTY: That is a mere question of law.

Sir H. DAVEY observed that his learned friend, in order to succeed, must show that the Referee could not legally do what he had done; that was to say, that a jury would have been guilty of misconduct such as would have justified a fresh trial if they had taken this item into account in estimating the damages. What the Referee did was to give interest at the modest rate of 3 per cent. up to the date of the award. The plaintiffs had been kept out of their money for some months; and a jury and an arbitrator were not only warranted, but ought to give, as part of the damages, compensation for the delay in payment.

Justice CHITTY: You are not recovering a debt; you are recovering damages.

Sir H. DAVEY: Damages for delay in payment.

Justice CHITTY: That is your order. It is not like a debt due to you.

Sir H. DAVEY: It is part of the damages, as the Referee fairly states the way in which he thinks they ought to be assessed. My learned friend will have to make out that what the Referee has done is wrong.

Justice CHITTY: The order referring was a reference as to damages.

Sir H. DAVEY: An inquiry as to what damages have been sustained by the plaintiff Company; and it is directed that the defendant Company shall pay to the plaintiffs the amount of damages found to have been sustained. I submit to you that the question is not whether the Referee has exercised a sound discretion, but whether he was legally entitled to give interest as an item of damages; and if his doing so is not contrary to law, his award is conclusive, and ought to be allowed.

Mr. DANCKWERTS followed on the same side.

Mr. MARK KNOWLES, in opposing the motion, observed that this matter did not come before the Court as if it were a case in which an arbitrator had absolutely allowed damages. The question was whether in this case, having regard to the action in itself, the interest was recoverable at all as damages; and he submitted that it was not. He thought the action was exactly like others that had been tried, especially that of *Crockford v. Walker*. There the question was one purely of interest; and it was held that this was not recoverable, even if the money had been obtained fraudulently. That was a case identical with the present one. His learned friend ought to have shown that there was some power to calculate damage by way of interest; and this he had not done. He submitted that this was nothing but an attempt to recover a debt, and said that his Lordship would see that in the first day's proceedings before the Referee, Mr. Danckwerts abandoned the action as one of trespass, and that damages were never mentioned before his Lordship made his order.

Sir H. DAVEY: Surely it was mentioned in the House of Lords.

Mr. KNOWLES: The first time damages were claimed was in the month of October, 1889. Up to then not a word had been said about interest by way of damages.

Justice CHITTY: The House of Lords gave a proper judgment, and awarded an inquiry as to damages. I do not see how interest could have been mentioned up to that time.

Mr. KNOWLES: They had given us a statement of claim, but had excluded interest. My contention is that they have altered the form of the action; and now, instead of it being an action for trespass, it is simply a question of money had and received.

Justice CHITTY: It is what damages have been sustained by the plaintiff Company. That is the inquiry the Referee has proceeded upon. I only made a formal order.

Mr. KNOWLES: Yes; but there stands the fact that they had given us particulars as to their alleged damages, and these particulars contain nothing by way of interest. Apart from this, your Lordship will see, from the report of the first day's proceedings on the arbitration, that practically all this was abandoned before the Referee.

Sir H. DAVEY: Are we to go into the proceedings before the Referee?

Mr. KNOWLES affirmed that he had a right to do so, because the real question was whether, in an action of this sort, it resolved itself into an action for money received. The learned Counsel having referred to other authorities, including the case of *Phillips v. Homfray*, in support of his argument, submitted that the Referee, sitting as a jury to ascertain damages, could not add to the damages found at a certain date the interest due since.

Mr. DANCKWERTS having replied, in the absence of Sir H. Davey,

Justice CHITTY delivered judgment. He said the inquiry before the Referee, as directed by the Court, was simply an inquiry as to what damages had been sustained by the plaintiff Company; and the Referee had found that the sum of £5804 15s. 2d. was the amount of such damage. He had also awarded a further sum, not as interest *eo nomine*, but as damages, which sum was arrived at by means of a calculation of interest; and he awarded that sum if it could be legally recovered. Therefore, the only question he (Justice Chitty) had to consider upon the motion—there could be no question as to the validity or the effect of the award—was whether the Referee could lawfully have included in his calculation of damages the sum of £388 16s. 10d. Now, the nature of the action was this: The plaintiff Company had a parliamentary monopoly for the supply of gas within a certain prescribed district. The defendant Company had, in violation of a prohibition found in the statute, invaded that district, and supplied gas which would otherwise have been supplied by the plaintiff Company. The inquiry was in the form directed by the House of Lords; and what was to be ascertained was what loss the plaintiff Company had sustained by reason of, or indirect consequence of, the defendants' acts. The Referee found: "That the damages which have been sustained by the plaintiff Company amount, exclusive of interest, to £5804 15s. 2d.; and as regards the question of interest, which has been a matter of contention between the parties in the said reference, I further award and find that the whole of the said amount of £5804 15s. 2d. would, but for the acts of defendant Company complained of by the plaintiff Company in the said action, have been paid to the plaintiff Company by their customers in various quarterly instalments, extending from the 31st of December, 1886, to the 30th of September, 1889; and further that, by reason of the acts of the defendant Company complained of, the plaintiff Company not only suffered a loss of the amount of the said instalments, but were also deprived of the advantage that would otherwise have accrued to them from the employment or the investment of the said respective quarterly instalments; and further that a reasonable and proper way of ascertaining the amount of loss which the plaintiff Company sustained thereby is to calculate the interest at the rate of 3 per cent. per annum upon each of the said respective instalments from the date when the same would have been respectively payable up to the date of this my award." Then the Referee gave the total amount of the interest which was calculated; and he concluded his award by the statement which he (Justice Chitty) read at the commencement of his judgment. Now, what the plaintiffs were entitled to ask should be done as the result of the ascertainment of damages was, to put them in the same position that they would have been in but for the wrongful acts of the defendant Company. Interest was not claimed here by statute; but it was contended by the plaintiffs that this was the right way to ascertain what damage they had suffered. Their loss consisted first in their not having received the profits they would have made by the supply of gas if their monopoly had not been infringed; and, secondly, in their not having received those profits at the time when they would have been payable. Upon those matters the finding of the Referee was clear and conclusive; and he (Justice Chitty) could not see that there was any legal objection that could be urged to his mode of ascertaining the damage. In substance he had found what loss had been sustained by the plaintiffs. They had lost money which they would have received if it had not been for the wrongful acts of the defendant Company; and consequently the Referee had allowed 3 per cent. interest—not as interest (that was disclaimed), but in respect of the time during which the plaintiff Company had been deprived of the exercise of their monopoly. He thought there was no legal objection whatever to what the Referee had done; and he must make an order for the payment of the £388 16s. 10d., as well as for the payment of the larger sum.

Mr. KNOWLES: Will your Lordship allow us time to appeal, as this is a very important question.

Justice CHITTY: You have a right to appeal.

Mr. KNOWLES: We are quite prepared to pay the money into Court. There is no difficulty on that score.

Justice CHITTY said the money could be paid into Court, if that were preferred; but he did not consider it was worth the trouble.

Mr. KNOWLES did not think it was necessary, because they should decide at once what course they would adopt.

COURT OF SESSION—SECOND DIVISION.—Wednesday, Nov. 19.

(*Before the Lord Justice* CLERK, *Lord* YOUNG, *and Lord* RUTHERFORD CLARK.)

Ovens and Sons v. The Bo'ness Coal Gaslight Company.

This action was brought by Thomas Ovens and Sons, chemical manufacturers, of Leith and Bo'ness, to recover £258 as the amount of loss inflicted upon the pursuers by an explosion of gas in their manager's house on the morning of Nov. 29 last. The gas entered the house from the roadway, where there was an escape from the defenders' main; and it was maintained by the pursuers that the escape was the result of the defective laying of the main. The pipe was laid on the turned and bored principle, without the joints being packed with lead. In the Outer House in June last, Lord Trayner, after hearing evidence, stated that in his opinion this was the system of pipe-laying now usually adopted; and as this pipe had given satisfaction for four years—this being the first joint which had ever leaked—he concluded that the line of piping had been well and properly laid (see *ante*, p. 93). The leakage on this occasion was caused by a subsidence of the ground, for which defenders could not be held liable; and he gave them absolution, with expenses. The pursuers appealed to the Second Division of the Inner House.

Lord Justice CLERK, in giving judgment, said the opinion which the Lord Ordinary had come to could certainly be taken upon the evidence; but it was incumbent upon them to examine the evidence, and to see what impression it made upon their minds. A number of very weighty questions of law were raised, which would have required time for consideration; but he did not think they needed to enter into these elaborate questions at all. In his opinion, the real issue upon which the case turned was whether or not the defenders were in fault in what they did—that was to say, whether or not they took reasonable care in the work which they executed, or whether their failure to execute the work with due and reasonable care was what caused the accident. In the first place the defenders had to lay down a pipe in forced earth which had not settled down, but remained loose, and in a shaky condition. This was to be gathered from the evidence for the defenders themselves. The next thing was that they were laying down pipes on a curve of considerable radius, involving that each pair of pipes must be 2 or 3 inches off the straight. They adopted a pipe which was becoming common now, of which there were two classes, one of which had an arrangement for packing, and the other had none. The one which the defenders adopted was the one which had an arrangement for packing. That they did that knowingly was absolutely certain, because in their specification of how the work was to be done, they stated that these joints were to be packed. It certainly was remarkable that they should specify for packing; and yet after all, no packing was put in. It was a question also whether there was sufficient cover over the pipes. The depth was 2 feet 6 inches. But it was necessary to have stretches of the pipe laid with a certain dip to prevent the collection of water; and it so happened that at this place the pipe on that account was nearer the surface than the depth specified. Now, the pipe being laid in forced earth and near the surface, a greater amount of care should have been exercised, because of the greater risk of the pipe being subjected to strains which would loosen the joints. No doubt joints of this description would be perfectly tight if they remained undisturbed; but to his mind it seemed an impossible thing to have two straight pipes, one of them with a socket and the other with a wedge-shaped end, fit exactly together if they were not to be on a straight line. There must, whenever they went upon a curve, be a certain amount of looseness of the joints; and he did not understand the explanation that, in order to overcome this difficulty, they looked for a badly turned end of a pipe. He thought that, where they had a curve, they ought to have the joints packed, because it served a useful end where there was any risk of strain. It could serve the useful end in two ways—either by making the resistance to the breaking effect of the strain greater, and thereby preventing the breakage, or where the strain had been effectual in causing an injury to the joint, in preventing, or at least very substantially diminishing, the leakage. The witnesses differed upon the question of whether or not this curve required packing. To a certain extent it bore upon the question that, when a leak did occur, it had most serious consequences. The leak here must have been a very serious one. In his opinion, the fact that they had a pipe going round a curve, through forced earth, and that such an accident took place, was, in itself, evidence of fault on the part of the defenders; and when he came to the fact that what was specified to be done was not done, he was driven to the conclusion that the laying of the pipe was not executed with due care, and was unsafe. He therefore thought the judgment of the Lord Ordinary ought to be reversed.

Lord YOUNG and Lord RUTHERFORD CLARK concurred.

Accordingly Lord Trayner's judgment was reversed, and decree was given for the sum sued for, with expenses.

CHANCERY COURT OF LANCASHIRE—MANCHESTER.

Tuesday, Nov. 18.

(*Before Vice-Chancellor* BRISTOWE, Q.C.)

Ancient Lights and Large Gasholders.

An action having been entered at the instance of the Wood Street Mills Company of Bury to restrain the Bury Corporation from interfering with their ancient lights by erecting a large gasholder near their mills, the matter came to-day before the Court on an appeal from the Registrar on a question of the defendants refusing to answer certain interrogatories administered by the plaintiffs. For 20 years past, the gas-works have been on land opposite the premises of the plaintiffs. A gasholder which rises to a height of 30 feet, has during this period occupied part of the site. The Corporation, in order to increase their storeage capacity, are about to demolish the holder, and erect a larger one, 90 feet in height, in its place. By the erection of the new holder the lights owned by the plaintiffs, it is alleged, would be very materially interfered with. It was stated on behalf of the defendants that the consumption of gas in the town had increased so largely within recent years that the Corporation were advised that they ought to enlarge the holder; and it was pleaded that the carrying out to completion of the proposed enlargement would be justifiable. The plaintiffs wished to interrogate the defendants as to whether they were not in possession of land, on the site of their present authorized works, which could be utilized for the purpose of providing further storeage accommodation.

Mr. EASTWOOD appeared for the plaintiffs; Mr. MABERLY for the defendants.

The VICE-CHANCELLOR, in giving his decision, said that the Corporation, being empowered by Act of Parliament to supply gas to the town, were authorized to do the work in a manner most convenient to themselves, so long as they did not infringe any statute; and he could not give the plaintiffs the relief they asked for. If the Corporation had come to the conclusion that this was the most convenient way of increasing the storeage room on the works, he could not grant a sort of roving inquiry as to whether or not they could go elsewhere. The motion must, therefore, be dismissed with costs. He was sorry the plaintiffs had to pay the Corporation their costs; but he did not mean at all to say that the plaintiffs had adopted a wrongful method in trying to obtain information—only it did not appear to him that the information would be of use to them.

MISCELLANEOUS NEWS.

THE POWERS OF GAS COMPANIES AS TO CUTTING OFF A SUPPLY.

A Move in the Direction of Amended Legislation.

The proceedings recently taken by a consumer of the Brentford Gas Company to recover damages against them for entering his premises to cut off the supply of gas in default of payment of his gas bill, which were lately reported and commented upon in our columns, have given rise to doubt as to the legal course to be followed in similar cases. With a desire to remove this doubt, as far as they are concerned, The Gaslight and Coke Company have notified their intention of applying to Parliament for further powers in this respect, the scope of which will be gathered from the following extracts from the statutory notice.

It is proposed to bring in a Bill to confer upon the Company all such powers and privileges as may be requisite or expedient for the purpose of avoiding, as far as possible, the breaking up of streets and roads for the purpose of cutting off the supply of gas to houses, buildings, and premises supplied by them with gas; also further powers enabling them the more readily to recover amounts due to them from consumers. Authority will be sought for the Company, their agents and workmen, to enter into any house, building, or premises supplied with gas by the Company for the purpose of cutting off the supply, and to cut off such supply. The Company wish to be relieved from the operation of section 22 of the Gas-Works Clauses Act, 1871, and section 67 of their Act of 1868, so far as these Acts relate to the requirement that notices to be served thereunder shall be signed by, or under the hand of the Secretary or other properly authorized officer; and to make and enact other provisions in lieu thereof. In the Bill to be applied for, provision will be made for the recovery by the Company of any costs and expenses they may incur in cutting off a supply of gas; as well as for imposing penalties upon all persons resisting the lawful entry of premises by the Company and their acts within such premises in relation to the cutting off of the supply of gas. By the means specified, and by such others as may be defined by the Bill, the powers of the Company for the recovery of gas-rents are to be extended, so as to diminish the public inconvenience arising from the exercise by them of their existing statutory powers. All rights and privileges which would in any manner impede or interfere with the objects and purposes of the Bill are to be varied and extinguished, and other rights and privileges conferred. So far as may be necessary for any of the objects and purposes mentioned, it is proposed to repeal, alter, or amend all or some of the powers and provisions of the Gas-Works Clauses Acts, 1847 and 1871, the Metropolis Gas Act, 1880, the City of London Gas Act, 1868, The Gaslight and Coke Company's Act, 1868, and all other Acts amending that Act, or relating to the Company, or which it may be necessary to alter, repeal, or amend for carrying into effect the objects and purposes of the Act for which application is to be made.

THE FATAL EXPLOSION AT THE MIDDLESBROUGH GAS-WORKS.

Although by dint of great exertion, and the employment of a good staff of men, coupled with the advice and assistance of his colleague at Stockton (Mr. W. Ford), Mr. David Terrace, the Manager of the Middlesbrough Corporation Gas-Works, was able to overcome, with as little delay as possible, the immediate effect of the serious accident which occurred at his works on the morning of the 15th inst., as reported in the JOURNAL last week, it was not until Tuesday that he was able to give the town a fair supply of gas. By that day, however, the exhauster engine, which had been buried in the ruins, was cleared, and once more brought into work; and it was thought that no further inconvenience would be experienced by the consumers. One curious incident resulting from the cessation of the gas supply on the day of the accident deserves to be recorded, as showing considerable fertility of resource. On the news that his motive power would be interfered with reaching the Manager of the *North-Eastern Daily Gazette*, he immediately took steps to ensure the printing of his paper by some other means than his gas-engine. He procured a gang of men from neighbouring works, and had heavy iron plates laid in the yard adjoining the printing-room, through the walls of which a large aperture was made. A 15-ton steam-roller was then brought into position, shored, and rapidly geared; and in an hour only after the usual time of going to press, the printing-machines began to work, and the whole of the impression was run off without a hitch. It is not often that a gas manager is in a position to say that a steam-roller has actually helped him to tide over a difficulty; and this must be the justification for acknowledging its services in the present case.

On Thursday afternoon, the inquiry into the circumstances attending the death of the unfortunate man Ogden, whose body was found beneath the ruins of the wrecked engine-house, was resumed by Mr. J. T. Belk. Witnesses having been called to give an account of the accident, and describe the state of the place before its occurrence, the Borough Surveyor (Mr. E. D. Latham) was examined. He stated that until recently he managed the gas-works. The building in which the engines were working, and over which there was a tank, was amply sufficient for the weight it had to bear. The inner walls were 15-inch, and the north wall was an 18-inch one. He estimated that the weight on the walls would be about 140 tons. This would be a safe load; but, in his opinion, they were calculated to bear four or five times as much. He therefore thought that no crushing weight had caused their fall. The three walls of the engine-house were all blown outwards; and he had come to the conclusion that the walls were forced out by an explosion. He considered it must have been a more serious escape of gas than could have come fromany of the jets burning in the engine-house; and he had the impression that there had been a sudden breakage of a pipe, or the joint of a pipe, under the engine-house floor. There were a number of pipes there; and some of them must

suddenly have given way, and a volume of gas in sufficient quantity had rushed up, mingled with the air in such proportions as to make an explosive compound, become ignited at the naked lights, and caused an explosion. Mr. Terrace was the next witness. He deposed that, when he left the works on the night previous to the explosion, everything was in proper order. When he was called in after the accident, the engine-house was a complete wreck. All the pipes in the house were strong; but there were two (partially attached to the tank) which had been expanding and contracting for years—one having a motion of ¼ inch, and the other of ⅜ inch. This going on for a long time had possibly weakened the walls, and caused them to give way. He had no conception that there was any escape of gas under the engine-house floor; and his impression was that there was no explosion till the walls had fallen. Mr. Doughty, a builder in the town, said he had examined the walls of the wrecked building, and considered them to be quite strong enough for the weight they had to bear. Mr. W. P. Ingham, an engineer, who had been retained by the Coroner to make an examination of the scene of the catastrophe, submitted a report, giving the result of his investigation. It was as follows:—

I find from what remains of the building and the plans of the same, which I have inspected, that the exhauster-house was built of brick, and was 36 feet long, 34 feet wide, and 14 ft. 6 in. high. The walls were 14 inches thick. On the top of the walls were eight strong cast-iron girders, built 9 inches into the walls. At each end on these girders and walls was erected a cast-iron tank 36 feet by 34 feet by 4 feet deep; and in this tank was an arrangement of wrought-iron condenser-pipes 16 inches in diameter, which were connected with each other at the ends by cast-iron junction-boxes. The tank, I am informed, was full of water at the time of the accident. I estimate the total weight of the girders, tank, condenser-pipes, cast-iron junction-boxes, and water in the tank—in fact, the whole weight carried by the walls—to be 190½ tons. From some cause or other, the walls, girders, tank, and contents have fallen. At first sight it appears that this collapse has been caused through weakness of some part of the structure. With this idea in view, I carefully examined those parts of the walls which were left standing for any old cracks; but I found no flaws likely to cause the collapse. It has been suggested to me that the expansion and contraction of the long pipes which conveyed the gas may have injured the brickwork, and loosened the girders of the exhauster-house. This, in my opinion, could not have been the case, as I understand that there was a vertical connecting-pipe between the two, which would most certainly have sprung or broken before it would have moved the weight of the tank and its contents. I therefore fail to find any evidence of structural defect or expansion and contraction at all likely to have caused the accident. I next examined the immediate neighbourhood and surroundings of the exhauster-house, with a view of finding any results that might have been caused by an explosion; and, as before stated, I found the whole of the four walls of the exhauster-house had fallen outwards—this proving that there had been some internal pressure; also the walls of the adjoining boiler-house are both leaning outwards out of the perpendicular. I also found some thousands of pieces of window-glass, broken into very small fragments distributed over the works. I noticed these particularly on the tops of the gasholders and the roof of the adjoining buildings—this proving that these pieces of glass had been lifted and blown up by some force; and this must have taken place before the fall of the walls. If the building had simply collapsed, this glass would have fallen to the ground with the other materials, and would not have been in such small pieces. In the case of an explosion, the glass windows of the building, being the weakest part, would be blow to atoms, and distributed as I found them. The walls of the building, being heavier, stronger, and fixed both top and bottom, would not, in my opinion, go so far, but (after some vent had been given by the destruction of the windows) would simply be forced outwards, and fall. I am informed that immediately preceding the accident a gaslight was burning in the exhauster-house. After carefully considering the whole of the foregoing facts, it is my firm opinion that there has been a leakage of gas from some pipe in the exhauster-house—probably from the main leading from the exhauster-house—until it formed an explosive mixture, which would be ignited by the light burning in the building at the time. The force of the explosion acting upon the walls of the building, which were not built to resist so great a lateral strain, gave way, and caused the collapse.

The Coroner pointed out that Mr. Ingham's view seemed practically to coincide with the theory set up by Mr. Latham. This concluded the evidence. Mr. Belk having briefly summed up, the jury, after a short consultation, returned the following verdict: "That the death of Wm. Ogden was due to injuries accidentally sustained;" and they added the following rider: "We think it incumbent upon us to call the attention of the Gas Committee of the Middlesbrough Corporation to the grave responsibility they incurred through the arrangement and construction of their plant at the time of the accident, whereby, through a comparatively trivial explosion, the whole of the town has been placed in darkness for such a lengthened period. We consider the arrangement of providing one set of scrubbers and exhausters common to both sets of retorts should be rectified, and that each retort-house should be supplied with the necessary appliances to work independently, so that in the case of the failure of one system, the other would remain unaffected and efficient, and that both systems should be provided with non-return valves whereby the gas, in case of accident, would be prevented from escaping from the gasholders. We further think that much more efficient means of ventilation should be provided in the exhauster-house, in order to allow of the diffusion of the gas which might be expected to some extent to escape in the house; and should the tank and condenser be erected in their present form, they should be independent of the engine-house walls, so as to make an accumulation of gas below the bottom of the tank impossible. We congratulate the Gas Committee on their having escaped the much more serious accident which the arrangement of their plant rendered possible." The inquiry then closed.

The Dinsmore Process at Darlington.—The Dinsmore process of manufacturing gas was started, in a formal manner, at the gas-works of the Darlington Corporation, last Saturday week. In the afternoon the members of the Gas Committee assembled at the works, where they found that the retorts set on the Dinsmore principle had already been heated. The Mayor (Mr. T. M. Barron), who is Chairman of the Committee, under the direction of the Gas Engineer (Mr. T. T. Smith), shovelled the first lot of coals into a retort, and other members of the Committee followed his example. They afterwards made a general inspection of the works.

LEEDS CORPORATION GAS SUPPLY.

The Corporation Auditors and the Gas Committee's Accounts.

The *Yorkshire Post* is responsible for the following statement in regard to the accounts of the Leeds Corporation Gas Committee: "The Finance Committee of the Leeds Corporation, at their meeting last Friday week, were somewhat startled, if not disgusted, as the ratepayers will be when they hear the cause. The Gas Committee's cup of trouble, full to the brim before, is now running over to a degree that must be truly alarming to Alderman Gilston and his associates in distress. As everybody in the borough knows, the tar, ammonia, and other residuals produced in the manufacture of gas by the Corporation are an important source of income. At present they are supposed to yield about £60,000 a year. Until recently they yielded a great deal more than that amount. In selling these residuals, the Committee stipulate, or are supposed to stipulate, that without exception, they shall be paid for within a month after the delivery of the goods. Thus, there should never be owing to the Gas Committee by its customers more than £5000 or so at any time. Imagine, therefore the consternation of the Finance Committee, when, on Friday, Mr. Derry, the Borough Accountant, announced that the Corporate Auditors (Messrs. Blackburn) had reported that accounts representing no less a sum than £41,000 were overdue! Mr. Derry is said to have been so deeply impressed by the seriousness of the situation, that he felt it to be his duty to inform the Committee exactly how matters stood. In the course of his report, the Borough Accountant stated that, since the adoption of the new arrangement concentrating all the finance departments of the Corporation in his hands, he had noticed these arrears for residuals accumulating. He had repeatedly called the attention of Mr. Lupton, the Gas Committee's Secretary, to what he considered a serious matter, but could get nothing done. In the course of a discussion, it was stated that Mr. Lupton had put impediments in Mr. Derry's way, and had not answered a letter in which, on the 28th of May last, the Borough Accountant had called attention to the arrears in the accounts for residuals. It also transpired that Mr. Derry had brought the subject under the notice of Alderman Gilston, as Chairman of the Gas Committee, and had merely received from that gentleman an assurance that the accounts should be looked into. These accounts, the Committee were informed, were in a condition so unsatisfactory, that the Corporate Auditors had found it impossible to complete their report. The defections which have brought the Gas Committee's finances to this serious pass, appear to have extended over a considerable time; for accounts representing no less than £31,000 were outstanding in the residuals department twelve months ago. It need scarcely be said that, before the consideration of the subject had proceeded far, several members wished to know how matters stood as between consumers of gas and the Corporation. The information that was quickly forthcoming was regarded by the whole of the Committee as being extremely satisfactory. Of £180,000 charged for gas supplied during the last half year, less than £3000 is still owing. It should be added, of course, that the allowance of 5 per cent. discount to those who pay for their gas promptly, is a powerful stimulus to the most neglectful users of gas. In the course of the discussion evoked by Mr. Derry's report, it is said to have been mentioned that residuals have not for some time been so good to sell as they were a few years ago, and that this may be one cause why longer credit has been given by the Gas Committee. Nevertheless, the Finance Committee, having made allowance for every extenuating circumstance of which they could think, were convinced that the matter was sufficiently grave to call for full inquiry, and that without delay. To that end the Committee empowered a deputation to seek an interview with the Gas Committee, with the object of quickening Alderman Gilston and his colleagues to a sense of their responsibility, and if possible, of transferring the duty of collecting the outstanding accounts for residuals from the Gas Committee's department to that of Mr. Derry. In justice to Mr. Lupton, it should be stated that some members of the Finance Committee did not blame him so much as the Committee who control him. Ratepayers who take the least interest in the town's business will naturally ask whether, by any amount of official exertion, assisted, if need be, by legal proceedings, all this £41,000 owing for residuals can be recovered; how much interest on these outstanding accounts has been lost; and who is really to blame."

On the publication of this article, one of the members of the Gas Committee, Mr. T. Ambler, proceeded at once to investigate the matter; and he has incorporated the results of his inquiry in a letter which has been published by our contemporary. On the face of it, he says, the Borough Auditors' report "is calculated to give alarm; and as the main residuals are tar, ammoniacal liquor, and coke, it would give the idea that this large sum is in the hands of three or four individuals, and that the Corporation were running the serious risk of losing, if not the whole, probably a large amount of this money. To begin with, whether the Auditors knew it or not—and if they did they should have stated it—there is one item of £13,376 which is not a residual at all, but a balance of mortgage owing on a property sold by the Gas Committee, and which is bearing interest. Next there is an item of £3253 15s. 7d. owing by the Lamp Committee. The Watch Committee owed £57 13s. 5d.; and the Highways Committee, £429 5s. 5d. Thus the sum of £17,116 14s. 5d. is accounted for, and reduces the £40,927 12s. 9d. down to £23,810 18s. 4d.; and for this amount it will be interesting for the public to know that there are 378 accounts owing of sums under £20; 60 accounts over £20, but under £50; and 52 accounts of over £50. Of this number, there was one account of £7086 4s. 2d., one of £3057 12s. 11d., one of £1808, and one of £184, all of which are paid. There was one of £838 15s. 5d., of which £408 is paid; and one of £366 6s. 2d., of which £378 is paid. Of the other accounts there was not one that reached £400."

The contractors for the tar produced at the Corporation gas-works (Messrs. Tunstall and Co.), writing on this subject, say that the above statements are calculated to do them serious injustice; and therefore they wish to point out that the accounts for tar are rendered to them monthly, and are all paid to Sept. 30 last. The account for tar supplied to them during October, and amounting to less than £1000, was

rendered only a few days ago. They have not asked for, nor have they been granted, longer credit or any concession consequent upon the depressed state of the residual market, nor from any other cause.

A letter has also been published by Mr. Lupton, in which he fully denies that, at March 25 last, there were outstanding accounts for residuals amounting to £41,000. This amount, he says, included £3253 15s. 7d. owing by the Lamp Committee for lamp account; and £13,376 balance of purchase-money of the Boar Lane estate—the amount outstanding for residuals at that date being £24,297 17s. 2d., the bulk of which had not then been rendered, and therefore could not be said to be overdue. Mr. Lupton continued: "At the time of the last balancing of the books—viz., June 30 last—the amount of residuals accounts outstanding was £14,848 19s. 5d., of which there are now only £3585 5s. 8d. unpaid. A few months ago Mr. Derry represented to me, I presume with the authority of his Committee, that the residuals accounts should be rendered monthly, which I duly reported to the Chairman of my Committee, who at once acquiesced; the matter having only been held over in consequence of the difficulties with which the Committee have had to deal in connection with the workmen. With that object in view, application was made at the last meeting of the Gas Committee for an additional clerk, which was granted; and therefore how it can be said that impediments had been thrown in Mr. Derry's way I cannot understand. I also wish publicly to state that all the residuals accounts known to be bad have been written off, and that the loss on sale of residuals for the last five years has not been more than 0·145 per cent., about 1-7th of a pound, or (say) 3s. per cent."

STRIKE AT THE BRIERLEY HILL GAS-WORKS.

Last Saturday week, the men in the employ of the Brierley Hill Gas Company went out on strike, in consequence of the Directors refusing to concede a demand made upon them by the Gas Workers' Union. The men asked: (1) That all stokers be paid 5s. per day, that the hours of labour be reduced to eight per day, and that the head stoker should have less manual labour to perform than the other stokers; (2) that fitters be paid 5s. per day of nine hours; (3) that main layers be paid 4s. 6d. a day of nine hours; (4) that the first lamplighter's wages be raised to 24s. per week, and the second lamplighter's to 22s. per week; (5) that all labourers be paid 3s. 4d. per day; and (6) that Sunday work be paid for at the rate of time-and-a-half, and that work on Christmas Days and Good Fridays be paid for at the same rate. Until the receipt of this demand, the Directors were ignorant of their employees being members of the Union. But upon the document coming before them, they declined to entertain any application or communication coming from an outside source. The men were informed of this determination to ignore the Union; and they sent a written communication (which was practically a copy of the Union's printed demands) to the Secretary; and this was considered by the Directors. As a result, the Manager was instructed to concede an increase in the wages of the men amounting to almost 10 per cent., and to inform them that the question of the reduction of the hours of labour could not be entertained. The men decided to give seven days' notice to terminate their engagements, which was accepted by the Directors. Men were at once obtained, principally from the country; and by the exertions of the Manager and his staff, the supply of gas has been kept up without the slightest inconvenience to the public. The new hands have been accommodated on the works at the expense of the Company. The Union men have placed pickets round the place; and the Directors have thought it expedient to requisition the services of the police for the protection of their plant and new hands. Our last information states that the strike still continues.

Bowman's Oxygen Lighting Company, Limited.—A Company under this title has just been registered with a capital of £125,000 in £1 shares, to acquire the right to use all or any of the patents granted or to be granted to Robert Davy Bowman for the generation of oxygen, and its application (among other things) to lighting, by combining it with coal gas, oil gas, water gas, or oil, and to the purification of gas and air; also to acquire the patents granted to him in Great Britain, France, and Belgium, and the right to apply for and obtain letters patent, or other special privileges, throughout the world, for the following purposes: (1) The manufacture and supply of special burners designed for burning oil, coal, and water gas, or oil, with oxygen gas; (2) the manufacture and supply of refractory cones for use in connection with these special burners; (3) improvements in hydrocarbon lamps, and in a regulator for the supply-tubes to the same.

Suggested Purchase of the Paignton Gas-Works by the Local Board.—The principal matter now engaging the attention of the Paignton Local Board is a proposal that they should acquire the works of the local Gas Company. They forwarded a request to the Directors, asking the terms upon which the Company would be disposed to part with their property, and in reply they received a letter stating that, while the shareholders would regret having their investments disturbed, they would, if the Board desired it, sanction the appointment of two skilled and competent engineers (one to be chosen by each party), and, in case of disagreement, they to appoint an arbitrator in the usual manner, to determine the terms on which the property should be transferred—this offer being left over for one month. At the meeting of the Board on Monday of last week, the question was briefly referred to. Mr. Bridgman, who did not altogether favour the idea of purchasing the works, proposed that they should consider the matter in Committee. Dr. Vickers, in seconding the proposition, observed that the gas-works ought to be the property of the town, as it was the only undertaking which could assist the rates. Mr. Parnell mentioned that, in the case of St. Marychurch, the gas-works would be paid for in two years; so that if the ratepayers of Paignton had their own works, the gas could be sold cheap, and public lighting would cost them nothing. The motion was carried.

THE PUBLIC LIGHTING OF WINCHESTER.

Gas v. Oil and Electricity.

Our readers may remember that on the occasion of the meeting of the South-West of England District Association of Gas Managers at Winchester in September last year, some rather strong, though perfectly justifiable remarks were made on the subject of the public lighting, which is done mainly by oil, under the immediate direction of the Corporation; the principal crossings, however, being provided with large gas-lamps. It is scarcely necessary to state that, in the year that has since elapsed, gas has held its position firmly, while opinions seem to have been shaken as to the suitability of oil as an illuminant for public thoroughfares. At any rate, the question of street lighting has lately been occupying attention; and a few weeks ago the General Purposes Committee of the Corporation were sent on a visit to Fareham, to inspect the system of electric lighting recently installed in that town. At the last meeting of the Town Council, the Committee presented their report. They stated therein that the installation comprised 21 arc and 85 incandescent lamps, and that the total cost of the lighting (which is being carried out by a private company under a contract) was £500 per annum, as compared with £490 for gas. The electric light displaces 121 ordinary, and 3 large gas-lamps; the approximate cost being £4 for an incandescent light, and £24 for an arc light. The capital invested in the undertaking is about £4000. As to the effect, the Committee said: "The result appears to be that the incandescent light costs nearly double that of the oil-lamps in this city—the illuminating power being no better than the oil-lamps; that the arc lamps lose much of their power by the opal globes, and cost double the price of the large gas-lamps used in Winchester, the illuminating power not being better; and that the erection of the high-mast posts to carry the wires is objectionable upon several grounds. These facts appear to indicate that any improvement in street lighting points in the direction of lighting by means of improved gas-burners, as the electric light is objectionable on the following grounds: (1) Waste of light; (2) the cost; (3) the erection of the masts to carry the wires." When the report came before the Council, Mr. Goodbody called special attention to the concluding lines, and urged the advisability of at once improving the lighting of the city by adopting some of the better kinds of gas-burners now available. He said he believed there were many who felt that the present lighting was a positive disgrace to the city. It would be useless to accept the report unless they followed it up with something practical; and therefore he moved as an amendment to its adoption that the Committee should proceed immediately to enter into arrangements for the better lighting of the city with improved gas-burners. Mr. Ward seconded the amendment. Mr. Kirby pointed out that there were two ways by which the lighting could be improved—either by using superior oil-lamps or by having additional gas-lamps. The present cost of the ordinary street oil-lamp was, he said, about £2 2s. a year, as against £3 5s. the last price quoted for gas of the same illuminating power. Alderman Warren said he could not agree that the oil lighting was a disgrace to the city, when it was a fact that the oil-lamps, which cost £2 2s. each, were rather better than the burners for which the Gas Company would have charged £3 5s. He held that the advance in oil-lamps during the past 50 years had been greater than the improvements in gas. They could read a watch-face 10 paces farther away from the oil-lamps than they could from the incandescent lights at Fareham, which cost £4 each, as against £2 2s. for oil. Mr. Barter said they could read the second hand of a watch 18 paces away from the incandescent lamps at Fareham, and 45 paces away from the arc lamps. By the same watch he found he could read the second hand 45 paces from one of the large gas-lamps. As to the oil-lamps and the incandescent electric lamps, the test gave the same conclusion—that the second hand could be read 18 paces away from each. On the amendment being put, it was lost by 13 votes to 6; whereupon a member said he was prepared to move that the matter be again referred to the Committee. This course, however, was considered unnecessary; and the subject dropped.

DUNEDIN CORPORATION GAS SUPPLY.

A short time ago a motion came before the Dunedin County Council, having for its object an inquiry by the Gas Committee into the general working of their department, with the view of effecting some economy therein. The investigation took place; and at a meeting of the Council on the 1st ult., a report was presented by the Committee. They stated that a close examination of the books had disclosed the following facts: The price of gas was reduced, as from Jan. 1, 1887, from 8s. to 7s. 6d. per 1000 cubic feet for ordinary, and from 7s. 6d. to 6s. 3d. per 1000 cubic feet for special supplies. At about the same time the charge for the public lamps was lowered from £4 2s. 6d. to £3 each per annum. Just then the price of coal advanced from 23s. 9d. per ton to 26s. 9d. per ton, then to 28s. 3d. per ton, and finally to 27s. 9d. per ton (the present price); while the coal was not found to produce so much or such good gas as formerly. The cost of maintenance of the works was increased last year, partly owing to providing for the abnormal exhibition consumption, and partly by the urgent necessity for repairs. From these and other unavoidable causes, it was found that the gas cost to make, sell, and distribute (all trade charges), in 1887, 5s. 5·2d. per 1000 cubic feet sold; in 1890, 6s. per 1000 feet sold—the revenue in 1887 being 8s. 7·75d. per 1000 cubic feet, as against 7s. 10·25d. in 1890. The lessened revenue in 1890 is to a great extent due to the quantity of gas consumed by the exhibition (9,278,000 cubic feet), which was supplied at the estimated net rate of 3s. 6d. per 1000 cubic feet. The increased cost, together with the decreased revenue, make a net difference of 16·3d. per 1000 cubic feet, which, on the ordinary production of the works (say 58 million cubic feet), represent the sum of £3939 3s. 4d. The Gas Department contributes largely to the Municipal Department by the sale of gas for lamps at a reduced rate, and free of charge for the Town Hall, clocks, fire brigade, &c.; and of tar and ashes for street purposes at nominal values. The Gas Committee pointed out that £100,000 from the gas account to the municipal account in 1888 meant

a loss of £700 a year in interest to the department. The manufacture and distribution appeared to the Committee to have been carried on with strict regard to economy and the convenience of the citizens; and they had no recommendation to make in this connection. They did not make any suggestions as to the best mode of improving the net result of the Gas Department; but said that, should the current year show an unsatisfactory account, it might be necessary to increase the price of gas in order to secure a fair trade margin of profit. The Chairman of the Committee (Mr. Solomon), in presenting the report, remarked that the loss on the gas undertaking had arisen from three causes—the Committee had lowered the price of gas, paid more for coal, and obtained coal of inferior quality for the higher price. Unless they could get better or cheaper coal, there would be no reasonable prospect of the Gas Department paying any better during the present year. There was no reason whatever to find fault with the Manager (Mr. D. A. Graham), or with the employees at the works; the loss of revenue being entirely attributable to the fact that a higher price had to be paid for an inferior coal. The consideration of the report was adjourned.

BAHIA GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held last Thursday, at the London Offices, No. 9, Queen Street Place, E.C.—Mr. E. HORNER in the chair.

The SECRETARY (Mr. T. Guyatt) read the notice convening the meeting; and it was agreed to take as read the Directors' report and the statement of accounts for the half year ending June 30 last. The report stated that the revenue account showed a net profit of £5330. This, with the balance brought forward (£3575), made the sum of £8905, out of which the Directors recommended the usual dividends on the preference shares, and a dividend at the rate of 8 per cent. per annum (free of income-tax) on the ordinary shares, which will absorb £6225, leaving £2680 to be carried forward. The retirement of Mr. Joseph Quick caused a vacancy in the directorate, which the Board had filled up by the election of Mr. H. W. Andrews. The Directors also regretted to have to report the resignation by Mr. A. J. King of his seat at the Board, in consequence of ill-health.

The CHAIRMAN, in moving that the report and statement of accounts be adopted, said he wished to make a few observations thereon. The balance of revenue was £5330, and was less by £3757 than for the corresponding six months of 1889. The difference was accounted for in this way: For the June half year of 1889, the *profit* on exchange was £3190, and the interest on the provincial bonds was £185—together £3375; both being exceptional items. Deducting this sum from £3757, the difference was £381, which was more than accounted for by the extra wear and tear, £393, which increased expenditure had already borne good fruit in improved carbonizing returns. The bad debts and allowances had increased by £412, and the *loss* on exchange was £684. But for these three items, the balance of revenue would have been £6821, as against £5711 for the corresponding six months of 1889. Salaries were higher; and this arose from a payment in the June half of this year which belonged to the December half year of 1889, but was in dispute when the December accounts were closed. On the other side of the account, they had an increased rental of £351. This, with a smaller consumption of coal (560 tons), and at a less cost of £779, was to his mind very satisfactory. The make of gas per ton of coal carbonized had been good; 10,180 cubic feet having been brought into charge. The unaccounted-for gas was 10·7 per cent. As to the cost of coal for the current year, although the price free on board had largely increased, the Board had been able to secure low freights, so that the cost on the works at Bahia would not be materially increased; and the stock of common coal on the works was more than sufficient to last till August next. The other items in the revenue account did not call for special remark from him. From the balance-sheet, it would be seen that the arrears were still far too large; but the political position and the state of trade during the past twelve months had seriously interfered with the Company's business and with the collection of accounts. Both these adverse causes were now much mitigated, and recent reports from the Engineer in Bahia led the Directors to hope and expect that the arrears would be largely reduced before the end of the current year. The political changes had also interfered with the negotiations for a renewal of the Company's concession. The elections being now over, they would endeavour to re-open the negotiations; but, of course, it would not be prudent at a public meeting to enter fully into this question. The shareholders might, however, rest assured that the Directors would do their best in their interest, which was also the Board's. In the second paragraph of the report, the shareholders were informed of the election of Mr. Andrews to a seat at the Board. The Directors considered the Company fortunate in having secured the services of this gentleman, seeing that he had had seventeen years, practical experience in the management of foreign gas-works, and he was now the Consulting Engineer in London of the Company he served abroad so long and satisfactorily. In case of need—though he (the Chairman) hoped it might not be necessary—he had no doubt that they might even count upon Mr. Andrews visiting Bahia. The third paragraph of the report dealt with the resignation of Mr. A. J. King. His retirement was a great loss to the Company, and a source of sincere regret to the Directors, especially having regard to the cause—ill-health.

Mr. HORATIO BROTHERS, in seconding the motion, said that, after the lucid statement of the Chairman, he had nothing to say, except with regard to the resignation of their late colleague, Mr. King. Some seventeen years ago, Mr. King and himself joined the Board, at a time when the ship, he might say, was without a captain or a rudder; and with the assistance of other Directors, they steered it to port. He thought that Mr. King was entitled to a hearty vote of thanks for his able services during the last seventeen years.

Mr. J. E. JONES said that he objected to the passing of the report and accounts. With regard to the paragraph in the former referring to the retirement of Mr. Quick, he observed that that gentleman's name did not appear on the balance-sheet dealing with the working of the half year ending December last; and it appeared to him somewhat irregular to resuscitate a directorship which had been quiescent for the purpose of filling the vacancy. At the last meeting he solicited attention to the extraordinary arrears which then existed; and the Directors assured the shareholders that the matter should have urgent attention. In December last, according to the balance-sheet, the arrears stood at £13,100. Reducing this by the quarter's accounts which had then been rendered (about £9000), brought it down to £3750. The present accounts showed that £600 had been wiped out as being bad. This was at least £450 in excess of any previous allowance for bad debts. Deducting £450 from the £3750, it would be seen that the arrears in December last stood practically at £3300. The arrears now stood at nearly £15,000, which, on being reduced by the quarter's accounts just sent out, made £5500, as against £3300 six months ago. He asked the shareholders whether this was consistent with the duty which the Directors owed to them—that there should be, on a business of £18,000, an increase of very nearly £2500 arrears in six months. Another point was that they had a diminishing business; and yet they were largely increasing the stores. In six months the stocks had been enlarged by £1350; and since December, 1880, the sundry and other stores had been increased by £3070. With the large advance in arrears, and the smaller business, was this increase absolutely essential? In the half year ending June 30, there had been a decrease in the actual business done of 3½ per cent.; and since 1887 the diminution had been something like 20 per cent. In 1887 the revenue amounted to about £40,244; and in the year just closed, it came to £37,261, or a decrease of £3000. The revenue from private consumers in the year 1887 was £15,800; and in three years it had decreased to £12,800. In one half year alone the diminution amounted to £3000 (comparing June, 1886, with June, 1890). While there was this decrease in business, the cost of producing the gas had increased. In 1887 it was £15,278, as against £18,572 in the year just closed—in other words, it cost 37 per cent. to produce the income in 1887, as compared with 47 per cent. now. Why, he inquired, had the Directors taken no measures to put a stop to this state of things. The falling off in business had been rather more than 20 per cent. in the three years; and the increased cost of it 21½ per cent. He then went in detail through the increases in the various items of expenditure; and proceeded to complain that the Directors had paid away half year by half year dividends which had not been earned. Taking the current half year, the profit amounted to £5330; and the dividend recommended necessitated a sum of £6225. They were approaching a state of things in which their concession would be gone, and the business would be worth only a small sum—a sum vastly different to that which was set out in the accounts as representing the value of the concern. In conclusion, he moved an amendment to the effect that the accounts be not adopted; that they be referred back to the Board, for the purpose of ascertaining the exact amount of the Company's assets; that three shareholders be associated with the Board for the consideration of the matters he had referred to; and that a report be presented to the shareholders on an early day.

Mr. JAMES MEIKLE, in seconding the amendment, called attention to the fact that the balance of preliminary expenses (£2000) still appeared in the accounts.

Mr. MASON, who stated that he had made a careful analysis of the balance-sheets of the Company since 1885, generally endorsed the remarks of Mr. Jones. He proceeded to quote from a report for the years 1885 to 1889 by the British Consul of Bahia (Mr. G. A. Stevens) to the Foreign Office, in which he referred to the Company. He stated, among other things, that it was a purely British enterprise, inaugurated in 1862, with a contract for 30 years, which expired in June, 1892. From what he learnt there seemed little chance that the contract would be renewed; the management for the past eighteen months not having, unfortunately, given satisfaction. It was intended, if possible, to organize a local company; and Mr. Stevens had reasons to believe that an American company, a German one, and a Belgian would compete for it. The Municipality, if the contract was not renewed, were obliged to take over the plant at a just valuation.

Mr. MACHELL expressed the opinion that the gentlemen who had spoken had not done so in the interests of the Company, as what they had stated, if published, would not tend to improve their position.

Mr. H. FINLAY, in reply to the remarks made, said they had listened very attentively to what had been said by the three shareholders who first addressed the meeting. After the last meeting, they wrote a letter to the Board, in which it was stated that they were somewhat dissatisfied with the results of the Company's working, and desired an interview with the Directors. The Secretary wrote to them, making an appointment; and the Directors, at considerable inconvenience to themselves, were present to meet them, and were quite prepared to discuss any question. They failed, however, to put in an appearance. He asked the shareholders to hold the scales evenly between the Board and those gentlemen. Mr. Jones had only been a shareholder a few months; and he possessed ten shares. He came into the Company, with his eyes open, evidently for the purpose of making an oration there that day. The three gentlemen it was wished should be selected to confer with the Board only held 40 shares between them. The Directors were quite willing to confer with any of the shareholders who were dissatisfied with the working of the undertaking; but was it not very unfair for a gentleman who had only been a shareholder a few months to make a speech such as they had heard that day? Mr. Jones had hinted that he and other gentlemen could perform some wonderful things. On the Board they had, as Chairman, Mr. Horner, who for 30 years was connected with the Phœnix Gas Company, and occupied the position of Chairman in that important concern. Mr. Brothers was associated for a number of years with two stations of The Gaslight and Coke Company. Mr. Blount designed the Company's works at Bahia, and was there during their construction. Mr. Andrews was brought up at the gas-works in Dublin, and had been for seventeen years Engineer to a foreign Gas Company. With regard to himself, he had been connected with two of the London Gas Companies, and a Director of one of them. This he considered was a good record; and he would ask the shareholders whether they would entrust the business in their hands, or leave it to the gentlemen holding 40 shares between them. In making comparisons of gas accounts, the great secret was to find the amount

of gas sold, and actually booked for payment, per ton of coal carbonized; and looking at the accounts now presented from this point of view, they stood better than they had done for a considerable period. As to exchange, they had a loss there of £680; but no one could hold the Directors responsible for that. As to bad debts, the Manager had written off the sum he considered to be irrecoverable; and the Board intended writing off some more in the next half year. The item of wear and tear was a little in excess; but the outlay had already been repaid in improved results. Concluding his remarks, Mr. Finlay said that, if the shareholders could get gentlemen to represent them in a more capable manner than the present Board, so much the better.

The amendment was then put, when only three shareholders voted for it; the original motion being carried by acclamation.

The dividends recommended were declared, on the motion of the CHAIRMAN, seconded by Mr. HORATIO BROTHERS.

On the proposition of Mr. BROTHERS, seconded by Mr. FINLAY, the appointment of Mr. H. W. Andrews as a member of the Board was unanimously confirmed.

Mr. BROTHERS, replying to Mr. Jones, stated that the reason Mr. Quick's name did not appear on the previous balance-sheet was because, at the meeting he should have come on for re-election, no motion was made to that effect; and therefore they were compelled to omit his name.

The retiring Directors (Messrs. Blount and Finlay) were then re-elected—the former gentleman on the motion of Mr. BROTHERS, seconded by Mr. J. E. JONES; and the latter, on the motion of Mr. BROTHERS, seconded by Mr. MEIKLE.

The retiring Auditor (Mr. Magnus Ohren, Assoc. M. Inst. C.E.) was also re-elected.

Mr. OHREN, in returning thanks, said he might mention that he naturally took a considerable interest in comparing the balance-sheets half year by half year; and it would be gratifying to the shareholders to know that the working during the first half of the current year was perfectly satisfactory. The coal carbonized was 560 tons less than in the corresponding six months of 1889; and yet they made £351 more for gas. Before sitting down, he moved that a vote of thanks be passed to the Chairman, Directors, and officers, for the efficient manner in which they had conducted the Company's affairs during the half year.

Mr. R. L. ANDREWS seconded the motion, which was unanimously passed.

The CHAIRMAN having briefly replied, the proceedings terminated.

SINGAPORE GAS COMPANY, LIMITED.

An Extraordinary General Meeting of this Company was held last Wednesday, at the Cannon Street Hotel, E.C.—Mr. R. S. FOREMAN in the chair.

The SECRETARY (Mr. Robert King) read the notice convening the meeting; and it was agreed, as usual, to take as read the report and accounts for the half year ending June 30 last. The former stated that during the six months several extra public lamps had been lighted; and in July and August of the current half year 20 additional lamps had been erected, with orders in hand for 13 more; making 33 in all. The Manager was informed that 91 additional lamps had been entered in the municipal estimates for next year, the bulk of which it was believed would be passed by the Commissioners. It was also intended to erect 16 high-power lamps for lighting the new esplanade at Singapore. The accounts showed that the gas and meter rental amounted to £7527, and that the products, profit on fittings, and sundries had produced £2912. With the sum brought forward (£68), these amounts made the total income £10,507. The disbursements and usual writings off (including £250 added to the reserve fund) came to £8554; leaving an available balance for dividend of £1953. After paying the dividend declared, a balance would remain to be carried forward of £134.

The CHAIRMAN said that the accounts which had been submitted to the shareholders required only a few brief remarks from him with reference to the result of the Company's working during the half year. The gas and meter rental, so far as it applied to the private lighting, showed a slight reduction, owing to the increased use of kerosene for lighting purposes, and the general dulness of trade prevailing at Singapore. On the other hand, the public lighting exhibited an increase; and, as stated in the report, very satisfactory progress still continued to be made in that department. The rate of exchange for the half year had been rather more favourable, although the marked advance which took place some months since (but which, unfortunately, was only of short duration) occurred too late in the half year to cause any material improvement. The effect of the higher rate of exchange would be more apparent in the accounts for the current six months. The lower returns from products, fittings, and sundries, were attributable to the stagnation of trade, to which he had before alluded. It would appear, from remarks made from time to time in the local papers, that the "Chitties," or native farmers of revenue, with the Asiatic traders in debt to them, were standing almost on the verge of bankruptcy, and were unable to keep up their monthly payments. Their indebtedness to the different banks amounted to upwards of 2½ million dollars; and they were now asking for an extension of time to meet these liabilities. This application the bank authorities appeared inclined to take into favourable consideration; and it was believed that arrangements would be shortly concluded which would probably have the effect of causing a gradual revival of trade throughout the Straits Settlements. The collection of accounts still continued to be well maintained; and a considerable reduction had taken place in the cost of coal carbonized—the average price per ton for the half year having been £1 13s. 4d., as against £1 19s. 3d. in the previous half year, and £2 1s. 7d. in the corresponding period of last year. The stock of coal now stored on the works was estimated to last until about the end of June; and as there appeared to be no immediate prospect of a recurrence of strikes in the coal trade, the Directors hoped to arrange for future supplies at a reasonable cost. He concluded by moving—"That the report of the Directors and the statement of accounts for the half year ended June 30 last be received, adopted, and entered upon the minutes."

Mr. H. W. SMITH, in seconding the motion, said it must be gratifying to the shareholders to see that the Board were able to continue the dividend which they had paid during the past two or three half years, and also to set aside £250 to the reserve fund, which made £500 in the twelve months, besides carrying forward a larger sum to the next accounts than they had done in the two previous half years. He thought the shareholders would agree with him that the accounts they were asked to approve were very satisfactory.

The motion was unanimously agreed to.

The CHAIRMAN then proposed a dividend at the rate of 6 per cent. per annum, less income-tax.

Mr. F. A. M. NICOL seconded the proposition, which was carried.

On the motion of Mr. S. SPENCER, seconded by Mr. MAGNUS OHREN, a vote of thanks was passed to the Chairman and Directors.

The CHAIRMAN having briefly replied,

Mr. SMITH, in moving a vote of thanks to the Auditors, mentioned that one of them, Mr. C. Newton, had been very ill during the past few weeks; and this accounted for the delay in the issue of the balance-sheet.

Mr. SPENCER seconded the motion; and, referring to the reserve fund, said that, if they were likely to build it up, the day was not far distant when they would get a dividend of 8 per cent., as it would give the Company a good backbone.

Mr. B. GREEN having replied for himself and co-Auditor,

On the proposition of Mr. T. A. GREENE, seconded by Mr. MAGNUS OHREN, a vote of thanks was passed to the Secretary (Mr. R. King), to the Engineer and Manager at Singapore (Mr. W. T. Batten), and to the staff generally, for their services during the half year.

Mr. KING suitably responded, and the proceedings terminated.

METROPOLIS WATER SUPPLY.

Prospective Legislation Affecting the Water Companies.

In the JOURNAL last week we gave abstracts of two notices of intended applications to Parliament in the ensuing session for Acts dealing with the supply of water in the Metropolis. The larger of these measures, as we surmised last week, is that of the Committee appointed some time ago by the London Vestries and District Boards to take steps for placing the water undertakings in the hands of a public body. Since that notice appeared, one has been given by the Corporation of London for an Act to carry out their ideas in regard to the water question; the following being the purposes specified:—

To constitute and appoint, or to make provision for the constitution and appointment, and to incorporate a public authority or body, to be called the "London Water Commission," or by such other name as the intended Act may prescribe (hereinafter called the "Commission"), representing the interests of the water consumers of the City of London and the County of London, and adjoining boroughs and populous places, and if thought fit to provide for the appointment on the Commission of representatives of the Corporation of London, the London County Council, and other county, municipal, and local authorities, companies, and bodies interested in the water supply of the Metropolis and adjoining boroughs and places, or in the sources of such supply, and of the Conservators of the Rivers Thames and Lea, and of such public departments and such other bodies as may be provided by the intended Act, and to confer upon these authorities, companies, and bodies all such powers as may be necessary or expedient for improving or regulating such supply, and for giving effect to the objects of the intended Act; and to make all proper provision for defining and regulating the constitution and reconstitution, powers, duties, and obligations of the Commission, the nomination, retirement, qualification, and disqualification of the members, the conduct of their business, the appointment of officers, the keeping of accounts, and other similar matters.

To confer upon the Commission all such powers and authorities as may be necessary or expedient for giving effect (amongst others) to the following objects, or some of them, and to empower them to promote Bills in Parliament with respect to such objects or some of them—that is to say: (*a*) The acquisition, construction, and maintenance of waterworks, aqueducts, wells, reservoirs, and works for securing an alternative or independent water supply; (*b*) the acquisition by agreement, or upon such other terms as may be authorized by Parliament, or provided for by the intended Act, of any existing or future water-works, or any water or right to take or convey water within the watersheds of the Rivers Thames and Lea, and any rights, powers, and privileges of any water company or of any public authority therein; (*c*) the dissolution and winding up of any company whose undertaking may be acquired, and the application of the purchase-money; (*d*) the supply, within such area as Parliament shall from time to time authorize or direct, of water by meter or otherwise for all necessary public and private purposes (including, if thought fit, a free supply to public baths, washhouses, and hospitals), and the carrying on, as trustees for the inhabitants of such undertakings as the Commission may by authority of Parliament acquire or construct; (*e*) the regulation until the acquisition by the Commission of the undertaking of any company, or during such other period as the intended Act may provide, of the price or rate to be charged or levied for the supply of water by such company, and the mode of calculating or ascertaining the same, and the dividends on a sliding scale or otherwise to be paid by such company, with a view to the equalization or uniform adjustment of the price or rate to be charged or levied within the area aforesaid; (*f*) the making of regulations for prescribing the strength, character, weight, and materials of the appliances to be fitted after the passing of the intended Act in connection with the supply of water within the City of London and the county of London, and for enforcing the stamping thereof; (*g*) the appointment of Committees jointly with any county councils, municipal corporations, bodies of conservators, and urban and rural sanitary authorities interested in the control or management of the Rivers Thames and Lea and the respective tributaries and watersheds thereof out of their respective bodies, for improving and preserving the sanitary condition of such rivers and their respective tributaries and watersheds; (*h*) the raising of money for the purposes of the intended Act and of the Commission, on such

securities and in such manner as may be authorized by Parliament; (*i*) the making and holding of any public or private inquiry into the existing supply of water within the said watersheds, and the charges made for the same, and into the present and possible future sources of such supply, and the entering into negotiations with any public authority, water company, or person for the acquisition of any of their powers or undertakings, or any part thereof; (*k*) the alteration of the members, constitution, and powers of the Commission, and the obtaining all such further powers as they may deem expedient for giving effect to the objects of the intended Act.

The remaining paragraphs of the notice refer to the purchase and holding of lands, providing suitable offices, the compensation of the directors and officers of any undertaking acquired, and the repayment to the Corporation of such money as they may furnish to the Commission for the purposes of the Act. As in the notice given on behalf of the Vestries, provision is made for the repeal or amendment of the Acts of all the London Water Companies, as well as the General Acts relating to the supply of water. The Bill is to be introduced on petition; and copies will be available at the usual time next month.

Notice has been given by Messrs. Dyson and Co. of a Bill to amend the law as to the charges made by the Metropolitan Water Companies. It will provide "for altering the charges, rates, or rents which may be made and levied by the Companies, or any of them, and the conditions on which they may be made and levied;" also "that from and after a time to be specified in the Bill, an increase in the value or valuation of premises supplied with water shall not enable the Company to make any increased charge, or levy any increased rent in respect thereof." The Acts which it is proposed to amend are the Metropolis Water Acts of 1852 and 1871, the Valuation (Metropolis) Acts, and any of the other Acts relating to the Companies.

The London County Council and the Water Supply.

At the Meeting of the London County Council last Tuesday, the Special Committee on Water Supply and Markets reported that they had before them a copy of the parliamentary notice issued on behalf of delegates of the Vestries and District Boards as to a Bill relative to the London Water Supply. The main objects of the Bill were to empower either the Council or a specially constituted Water Trust to acquire the undertakings of the eight Water Companies, on terms to be settled by agreement or by compulsion; and also to provide supplemental or alternative sources of supply. In view of the introduction of this Bill, and of the possibility that it might be dealt with by a Parliamentary Committee in the course of next session, it was desirable that the Council should determine the course to be taken with regard to it. By the 38th section of its General Powers Act of last session, the Council were authorized to prosecute and conduct inquiries and negotiations relating to the supply of water, or the Companies supplying water, in or near London; and the Council empowered the Committee to enter upon them. They at first considered that the best course would be to hold an inquiry at which evidence could be taken, and, with this view, they put themselves into communication with the Water Companies. They, however, were unanimous in declining to submit evidence at such inquiry; and, as it appeared to the Committee to be essential, in an inquiry of this nature, that all sides should be heard, and that the investigation should be of an exhaustive nature, they had come to the conclusion that, in the absence of the co-operation of the Companies, it was not desirable to enter upon an inquiry in this form. The Council could not promote any Parliamentary Bills relating to the water supply, but could oppose Bills in Parliament affecting the County of London; and the Committee had come to the conclusion that the most desirable course for the Council to take was to obtain information and prepare evidence, with a view to its being submitted to any Parliamentary Committee dealing with the question. In connection with this subject, they referred to the report recently issued by the County Purposes Committee of the Corporation of London relative to the inquiry held by that Committee [see *ante*, p. 860]. It appeared to them that, although much valuable information was submitted to the Committee, the inquiry was open to the objection that it was *ex parte*, and that the Water Companies did not submit evidence. The conclusion come to by the Corporation Committee was that, as the Water Companies who supply London also serve large areas outside, Parliament should create a Water Authority consisting of representatives of the governing bodies over the entire areas of the watersheds of the Thames and Lea, and that such authority should govern the watershed and manage the supply. The Committee also pointed out that the prosecution of a Bill relating to the London Water Supply must fall upon the Corporation, as at the present time no other public body has power to incur the necessary expenditure. Should the Corporation introduce any such Bill, it would be necessary that the Council should be prepared to submit evidence upon it. They did not propose at the present time to enter upon the merits of the proposals made either by the delegates of the Vestries and District Boards or by the Corporation, as the Bills embodying these proposals were not yet before them; but it was obvious that the creation of a Water Authority over such an extensive area as that indicated must raise very serious questions. In recent legislation relating to the water supplies of provincial cities, Parliament had invariably given the Corporation of the city to be supplied the sole control of the water undertaking; providing, however, for the supply by the Corporation of sufficient water for the surrounding districts. While holding these views, the Committee felt that the Council and the Corporation were at one in desiring to place the supply of water to London in public hands; and they were now in communication with the Corporation on the subject. They recommended—"That it be referred to the Parliamentary Committee to take, in conjunction with this Committee, the necessary steps to enable the Council to submit to Parliament its views on any Bills dealing with the water supply of London which may be introduced during the ensuing session." The report was adopted without discussion; it being arranged to insert the words "subject to any necessary resolutions under the Act relating thereto" after the words "this Committee."

Suburban Local Authorities and the Projected Water Trust.

On Monday last week, a conference of representatives of Sanitary Authorities of Middlesex, Essex, Herts, Surrey, and Kent was held at the office of the Chairman of the Essex County Council, No. 35, New Broad Street, to consider the question of the water supply of London and the suburban districts. The conference was invited in pursuance of a resolution passed at a meeting on the 14th ult. of representatives of Sanitary Authorities in the county of Essex, who adopted a resolution approving the proposal to bring the water supply of London and the sub-Metropolitan districts under one public authority, but protesting "most strongly against that authority being the London County Council alone," and pledging itself "to oppose any scheme which does not give the sub-Metropolitan districts full representation in proportion to their population—the proportionate representation to be revised after each census." Sir H. J. Selwin-Ibbetson, M.P., was voted to the chair, and there was a good attendance. The Chairman said that some years ago, when Mr. Cross and he were at the Home Office, the question of the water supply of the Metropolis was under consideration; and they believed they had proposed a successful mode of dealing with it. They certainly did not then contemplate—and he hoped it would never be contemplated—to leave out of the management of the future water supply of the Metropolis areas so largely interested as those whose position they had that day met to consider. The question affected a very large number of interests; and he had been glad to see that, in their contention, they had the support of the Corporation of London, whose Committee, in their recently-issued report, stated that they had no hesitation in recommending the Corporation to suggest to Parliament "a representation of the areas as the most effectual way of governing the watershed and managing the supply." Some of the local authorities, it appeared, thought it best to wait till the Bill was before the House of Commons before they took action; but, as "an old parliamentary hand," he said they were wrong. If they wished to put pressure on, the best way was to do so before the Bill was brought in; for it was much easier to make alterations during the preliminary stages than when it was before the House and the subject of contest. Mr. W. B. Whittingham (Chairman of the Walthamstow Local Board) proposed the following resolution: "That this conference of representatives of Urban Authorities of districts outside the Metropolitan area, but depending for their water supply upon the London Water Companies, affirms the principle that any Bill brought before Parliament for the purchase and control of the London Water Supply must provide for the full representation of areas affected beyond the Metropolitan boundary." Sir T. Fowell Buxton seconded the motion, and it was carried unanimously. Resolutions were passed requesting the President of the Local Government Board (Mr. Ritchie) to receive a deputation, appointing a Committee to watch the progress of legislation and summon a meeting of representatives when deemed necessary, and inviting each Corporation and Local Board interested to contribute £2 towards incidental expenses.

The Quality of the Water Supply in October.

Messrs. Crookes, Odling, and Tidy, in their report for last month on the composition and quality of daily samples of the water supplied to London, say: "Throughout the month of October the character of the water supply to the Metropolis continued to be entirely satisfactory, in respect alike to freedom from turbidity, from colour-tint, and from any excess of organic matter. The mean proportion of organic carbon present in the Thames-derived water was only 0·136 part in 100,000 parts, with a maximum of 0·160 part in any single part examined. The mean ratio of brown to blue tint of the same water was as 10·4 : 20; while the mean amount of oxygen taken up in the oxidation of the organic matter in a gallon of the water was just under 0·4 grain."

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 177,723,730 gallons, as compared with 170,403,008 gallons in the corresponding month of 1889; being at the rate of 29·7 gallons per head of the population, as against 28·9 gallons in October last year. Of the entire bulk of water sent out, 89,591,025 gallons were drawn from the Thames, and 88,132,705 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health, was: Kent, 0·8; Colne Valley, 0·9; New River and Tottenham, 1·0; East London, 1·5; Grand Junction and Lambeth, 1·6; Chelsea and West Middlesex, 1·7; and Southwark, 1·8. The water taken from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies was again of remarkable organic purity; and it was, in every case, efficiently filtered before delivery. Of the water obtained chiefly from the River Lea by the New River and East London Companies, that delivered by the New River Company was, as regards organic purity, equal in quality to the deep-well water of the Tottenham Local Board of Health; while the East London Company's water was slightly superior to the best of the Thames waters. Both waters were efficiently filtered. The deep-well waters of the Kent and Colne Valley Companies and of the Tottenham Local Board of Health were, as usual, of excellent quality for dietetic use. These waters were clear and bright without filtration. The Colne Valley Company's supply was softened before delivery, and thus rendered suitable for washing.

Lancashire Coal Trade.—Business was of a steady character during the past week; but prices were not so firmly held as was the case at the opening of the month. There are plenty of willing sellers; and as the demand for most descriptions of coal is anything but active, the tendency has been in the buyers' favour. House-fire coal has been in moderate request; and the quotations at the pit's mouth average 12s. to 12s. 6d. per ton for the better qualities, 10s. 6d. to 11s. for seconds, and 9s. to 9s. 6d. for common round descriptions. Steam coal for shipment is quoted at 10s. 6d. to 10s. 9d. per ton delivered at the docks at Liverpool. The better qualities of engine fuel have moved off fairly well; but slack continues to drag upon the market. Burgy is quoted at 7s. 6d. to 8s. per ton at the pits; better qualities of slack, 6s. 6d. to 7s. per ton; and common sorts, 5s. to 5s. 6d. per ton.

STOCKTON AND MIDDLESBROUGH WATER SUPPLY.

The Quality of the Water—The Supply of Kirkleatham.

Several references have lately been made in the JOURNAL to the quality of the water supplied by the Stockton and Middlesbrough Water Board, with respect to which a certain amount of suspicion has been excited owing to an outbreak of typhoid fever in the Middlesbrough district. Samples of the water just as it is delivered by the Board were submitted to Dr. E. Frankland a few weeks ago; and, as already mentioned, he reported it to be not only free from all traces of sewage or animal contamination, but (with the exception of a little discoloration, owing to the presence of perfectly harmless peaty matter, which also slightly affected the taste) in all respects of excellent quality for domestic use. Another sample was sent to some local analysts, whose report agreed substantially with that of Dr. Frankland. Their tests of the water showed that it was of a strongly peaty nature, but free from sewage contamination, and perfectly wholesome. With the view of obtaining a totally independent opinion, a sample of water was sent to Mr. A. H. Allen, F.I.C., F.C.S., of Sheffield, who formerly filled the position of President of the Society of Public Analysts. He reported the water to be of moderate hardness, and apparently of moorland origin; and added that the results of his examination negatived any suspicion of contamination by sewage or cesspool drainage, but pointed to the presence of an unusually large amount of vegetable organic matter apparently derived from peat. To this impurity he attributed the brownish colour of the water. He submitted the sample to both bacteriological and microscopical examination; but no suspicious results were obtained. In view of these reports, the origin of the distressing epidemic which is now prevalent in Middlesbrough must be sought elsewhere than in the water supply.

A short time ago, the Local Board of Kirkleatham expressed a desire to purchase the mains, pipes, and fittings within their district, which is now served by the Stockton and Middlesbrough Water Board. They accordingly applied to the Local Government Board for power to raise the necessary money to carry out the purchase. A local inquiry was held by Colonel Ducat, who reported that, although the Local Board originally proposed to borrow £4000, it was uncertain whether a far larger sum would not ultimately be required to cover the expenses of the acquisition. Taking this point into consideration, and also the fact that the revenue might not be adequate, even if 9d per 1000 gallons were charged, as proposed, the Local Government Board doubted whether the transaction would be for the financial interests of the district. They found also that the proposed change might operate to the detriment of some large consumers, unless definite agreements were made for the sale of water in large quantities at a low rate; and they were not satisfied that the supply from the Cleveland Water Company would be better in point of quantity and pressure than that which could at present be given. In view of these considerations, the Board thought they could not properly give their sanction to the raising of the proposed loan by the Local Board.

The Carriage of Gas Coal by Sea.—It appears that the shipping interest are aggrieved at the fixing of the winter season for bringing into force the provisions of the Load Line Act of the past session, which will come into operation on the 9th prox. The Act in question amends the Merchant Shipping Act, 1876, in this respect—that the maximum load-line for vessels in salt water is to be fixed at such a level below the deck as shall be approved by the Board of Trade. It is considered that this regulation will interfere seriously with the coal trade generally, and especially with the carriage of gas coal; and last week Mr. Akers-Douglas, M.P. for St. Augustine's, Kent, received deputations at Whitstable on the subject. It was pointed out that unless some relaxation of the provision is afforded, the supply of coal to the various gas companies in that division of the county will be greatly impaired. Mr. Douglas promised to give his earnest attention to the matter.

Hayle Gas Company, Limited.—The first annual meeting of this Company was held at Hayle on Monday last week—Mr. H. N. Harvey (Chairman of the Directors) presiding. The Secretary (Mr. Hy. Thomas) having read the Directors' report and statement of accounts, the Chairman moved their adoption, and congratulated the shareholders on the result of the first year's work. He said considerable progress had been made in all departments, which were still being pushed forward; and hopes were entertained of the business rapidly developing and proving highly remunerative. Two beds of six retorts each had just been erected on the Dinsmore principle, and would shortly be thoroughly tested; and it was hoped benefit would result. The profit on the year's working was £652. Mr. W. E. T. Bolitho seconded the motion; and it was carried unanimously. A dividend of 5 per cent., free of income-tax, was declared on the paid-up capital of £9200; and the balance (£192) was carried to a reserve fund.

Northern Coal Trade.—There is still a weak tone in the coal trade of the north; and prices are in some instances rather lower than they have been. For best Northumbrian steam coal, the price varies from 11s. 6d. to 11s. 9d. per ton free on board. For small steam coal, from 5s. to 5s. 3d. is now asked. Gas coal is in very full demand; and for best Durham, about 11s. per ton free on board is the price, though there is some expectation that a higher quotation will be given, as the miners are to receive in Durham a further advance of 5 per cent. For a month to come, the consumption of gas coal will be at its highest point; and though some of the companies have laid in considerable stocks, yet the demand for gas coal is now very large. Bunker coal is easy; the price varying from 9s. up to 12s. per ton. For manufacturing coal, a fair inquiry exists; and the contracts for next year are now being settled at prices which are not very dissimilar to those that have ruled this year. Coke for blast-furnace purposes is steady; the price being from £1 to £1 1s. per ton free on board. Gas coke is unaltered in price; but there is a good demand for shipment. A considerable quantity of gas coke has been of late sent regularly from the Tyne; and this steadies the local market for that article.

NOTES FROM SCOTLAND.

From our Edinburgh Correspondent.

EDINBURGH, *Saturday*.

The decision in the Second Division of the Court of Session on Wednesday in the action by Ovens and Sons against the Bo'ness Coal Gaslight Company is not giving satisfaction in gas circles; and there is a probability of the case being taken to the House of Lords on appeal. The decision of the Lord Justice Clerk, who led the Court, is an illustration of how a little knowledge may be a dangerous thing. His lordship is an amateur scientist; and it was apparent that in this case he based his judgment, not on the evidence, but upon his own reasonings. At the trial before Lord Trayner, in the Outer House, it was proved that this pipe had, four years before the occurrence, replaced an old pipe which was duly packed; and that the new pipe had been so well laid that it effected a reduction in the leakage from 22 per cent. to less than 12 per cent. That the accident was due to a subsidence of the ground, and not to the pipe being affected by any heavy weight passing over it, was also clearly shown. Lord Trayner's view that the leak was caused by a subsidence for which the Company were not responsible, was surely more reasonable than Lord Justice Clerk's opinion that if the Company had done something which they did not do, the leak might not have occurred. The decision of the Second Division is as bad as would be a judgment finding an employer liable in damages to an injured workman, not because the machinery was defective, but because it might have been improved; and that is a principle which their Lordships on the same bench refused to lay down the other day when such a plea was set up by counsel on behalf of an employee. Whichever way it is looked at, it is unsatisfactory to have judge-made law on a question of this kind, which ought only to be decided according to the opinion of experts. As the case will certainly rule all others which may arise, it is to be hoped an effort will be made to have the judgment reversed, and a decision given in accordance with the evidence, as I consider Lord Trayner's was.

By what must surely have been a grave oversight, the customary report by the City Analyst as to the quality of the gas produced in the Edinburgh and Leith gas-works, was submitted to the Edinburgh Town Council on Tuesday, though, as I explained several weeks ago, no Leith gas has been delivered within a mile of the City Analyst's premises for at least a year. His report again bears out what I said regarding the conditions under which when it was supplied, the Leith gas was tested; for it stated the Edinburgh gas, taken direct from the main, at 25-candle power, and the "Leith" gas—in reality Edinburgh gas after it passes through more than 200 yards of small service-pipe—at 24·20 candles. How the City Analyst should have had the hardihood to report on the two gases after it had been announced that there was now only one, I cannot imagine, unless upon the supposition that he had not been officially apprised of a change in the circumstances which would not be his neglect. The repetition of the blunder did not escape notice. Mr. Auldjo Jamieson asked whether or not they were to consider that as a true statement. It had been frequently repeated in the Council that there was only one gas; and why, if that was so, should they always have two analyses, differing from one another, of the same gas? Mr. Macnaughton said he understood from what had fallen from ex-Bailie Walcot that a new arrangement had been come to—which, however, was not yet in force—whereby the Leith and Edinburgh gas would be tested in future in a proper manner. Bailie Steel said it was a question whether, under the circumstances, the testing of the gas was worth paying £25 to £30 a year for. Mr. Gillies said he thought it was most important that these analyses should be continued. Oil-lamps were now being used to a very much larger extent in houses in Edinburgh than they used to be; and if the Gas Commissioners did not look after their manufacture better, that practice would go on, and the paraffin oil industry would get a great impetus.

Mr. Colston, whom I mentioned a fortnight ago as having lost his seat in the Edinburgh Town Council, was, notwithstanding, appointed by the Town Council on Tuesday to represent them on the Water Trust, so that he retains his seat there. It was also proposed to re-elect him to the Gas Committee; but after the expression of opinion that the members of the Committee should be members of the Town Council, and therefore amenable to the ratepayers, the proposal was dropped, and Mr. Colston, who did so much to bring the Gas Committee into existence, has now no longer any connection with it. Mr. Henderson, who defeated him in St. Andrews Ward, was appointed a member of the Committee. It is now rumoured that Mr. Colston is to take steps to unseat Mr. Henderson as the Ward representative. Should he be successful in that effort, he will doubtless appear once more in the Commission, where most impartial people will agree that he should be.

The Corporation of Edinburgh have at last entered the field with something like a definite proposal with reference to electric lighting, in the notice they have given this week of their intention to apply to Parliament for a Provisional Order under the Electric Lighting Acts. The powers they propose to take are the usual ones of the manufacture and supply of electricity, or to enter into contracts with other bodies for the supply. The portion of the city which is selected for the supply of electric lighting is, of course, the central, where business premises are thickest, and the west end, where the wealthier classes reside. But even in this selection there is a peculiarity—which may be possible of explanation, but which I cannot understand—consisting of the fact that in the west-end district it is proposed in some instances to supply one side of the street but not the other. One thing is noticeable, that in no case where a person of eminence has at any time expressed himself in favour of electric lighting being introduced, is his side of the street left out. There is to be, of course, a provision permitting them to grant a supply beyond the compulsory area, but that would probably be on higher terms; and thus it would appear that the compulsory area, though the Corporation are the promoters of the measure, has been selected with some degree of partiality.

The Magistrates of Edinburgh have given notice that they intend to apply to Parliament for enlarged police powers; and among other things for power to supply light to common stairs, passages, and private courts, to light and extinguish the same, and to recover the costs

from the owners or occupiers, or to charge the expense to the burgh assessments or other funds. The powers proposed to be taken are certainly ample enough to enable them to deal with the subject; and there may be some criticism of the proposal to charge the cost upon the burgh assessments, which, unless at great trouble, would lead to persons who occupy property in which there are no common stairs or passages, paying for the lighting of other people's. It is noticeable that the power asked is to supply light, which is a change, as hitherto the enactment has provided for a supply of gas for the lighting of common stairs, &c.

The Burghs of Scotland have been endeavouring for the last seven years to get a General Police Bill passed which would do away with a number of anomalies in the management of public business in the smaller towns. They are now, they think, within measurable distance of accomplishing their object. One of the clauses of the measure proposes to make it compulsory for the owners of common property to provide lamps, and a supply of gas or other light, as may be required by the Police Commissioners, and for the occupiers to light and extinguish the lights, under penalties. It also proposes to give optional powers to the Commissioners to impose a charge for the lights, and to light and extinguish them by their own servants.

The newly-constituted Dundee Gas Commission held its first meeting on Tuesday, and got themselves into harness by the appointment of Committees, &c. Ex-Provost Brownlee was elected Convener of the Works Committee, in succession to Mr. Joseph Lindsay, who sat on the Commission as a representative of the Nine Trades, and who has retired. Mr. Brownlee was last year a severe critic of some of the doings of the Works Committee; and his advent to the post of Convener may lead to some changes. As a first instalment, he was no sooner appointed than he called attention to the small amount of time—two days—hitherto allowed for the Commissioners to consider the tenders for coal; and, on his motion, it was agreed that in future a fortnight should be taken for the purpose.

The Aberdeen Town Council on Monday re-constituted its Gas Committee; and there, too, a considerable change was made. Mr. Collie, who has been Convener of the Committee for a very long time, has been, though placed on the Committee, removed from the convenership, which has been bestowed upon Bailie M'Kenzie. The reason given by Bailie Rust, who moved the appointment, was that he considered Bailie M'Kenzie to be the most suitable man in the Town Council to appoint as Convener of the Committee. Bailie M'Kenzie was appealed to, to withdraw and allow Mr. Collie to be re-elected; but he took no notice of the appeal, although the Lord Provost backed it up by saying there was a great deal of ungraciousness in the action. There is, I doubt not, a deeper reason than that assigned for making the change; but I would not be surprised though it went no deeper than that there is a new party in the Council who are resolved on keeping all the apointments among themselves. It is a pity Mr. Collie has been thus slighted, because he has done good work as Convener.

From our Glasgow Correspondent.

GLASGOW, *Saturday*.

The holder accommodation at the Glasgow Corporation Gas-Works has been materially increased within the last three years or so; but it is still insufficient for the increasing demand made for gas within the city and most of the extensive suburbs—being decidedly less than the greatest day's supply. About three years ago a new holder was brought into use at the Tradeston Gas-Works which has a capacity of well-nigh 1,250,000 cubic feet, the builders being Messrs. Clayton, Sons, and Co., of Leeds. Then the same firm put a third lift on a holder at the Dawsholm works, which had a similar capacity, but which has now been increased to about 1,600,000 cubic feet. Another holder at the same works has just been similarly enlarged by Messrs. Hanna, Donald, and Wilson, of Paisley; and within the past week this three-lift holder has also been brought into use. Whether or not the other five large two-lift holders are to be further telescoped has not yet been decided by the Corporation Gas Committee. There has lately been called into existence a Special Sub-Committee for considering the question of providing additional holder accommodation; and the tendency of their collective wisdom is in favour of laying down new holders on suitable sites, not necessarily portions of the present manufacturing stations. I am told that it is not unlikely that a beginning on one such new site will be made by the erection of a holder having accommodation for something like five million cubic feet. Evidently the days of the gas industry in Glasgow are not yet numbered.

By the instruction of the Glasgow Corporation Special Committee on Electric Lighting, Mr. Foulis, the Gas-Manager-in-Chief, has just compiled a report on data which he has collected regarding about forty electric lighting undertakings throughout the kingdom—both corporation and company concerns; and it is expected that the Committee, at their next meeting, which is to be held on the 27th inst., will take some further action, based on the report, and on the "expert" report which was obtained from Mr. R. E. Crompton some months since. It has not yet been decided by the Electric Lighting Committee whether they will recommend the Town Council to start a lighting station of their own, or to contract with one or more companies to undertake the lighting of the area which is made compulsory on them by their Provisional Order. From the slow, if not perfunctory, way in which the Special Committee are proceeding with their duties, it would almost seem as if they were only half-hearted in their business, remembering all the time that they are primarily Gas Commissioners.

It is expected that the new gasholder at Paisley will be ready for the ceremony of admitting the gas by about the middle of next month. Probably by Friday or Saturday of the ensuing week the water will be turned on into the tank which contains the holder. The quantity required will amount to about 3,100,000 gallons; and as the largest main in the vicinity of the gas-works is one of 5 inches bore, with a pressure of 70 to 80 lbs., it is likely that from seven to ten days may elapse before the immense cavity is filled. The ceremony of turning on the gas into the new holder will be performed by Provost Johnston; and in connection with this event, there will be held a semi-public banquet, on the occasion of which he is to receive from the contractors a very handsome present, in the shape of a Maltese cross in solid silver and bearing most suitable emblems—the whole being, I believe, the design of Mr. George R. Hislop, the Corporation Gas Engineer and Manager. It is expected that the total cost of the tank and holder will amount to about £28,000. By the way, I may mention that it is now just about twelve years since the last new holder was "inaugurated" at the Paisley Corporation Gas-Works. Its capacity is about 650,000 cubic feet, or scarcely half that of the holder which will be brought into requisition within the next three weeks or so.

There has been more excitement in the Glasgow pig iron market this week than has been the case at any time since the crash which occurred at the beginning of the present year. Within three days—from Monday to Wednesday—the price of Scotch warrant iron declined from 51s. 4d. per ton cash to 48s. For a time almost every holder was selling; and as the news came in from the Stock Exchange that a panic reigned there, the ironbrokers sold again. The closing price yesterday was 48s. 9½d. per ton cash buyers. In Cumberland hematite iron warrants, the price fell from 58s. 4d. on Monday, to 55s. 3d. per ton on Wednesday, yesterday's closing quotation being 55s. 10½d. per ton cash buyers; while Cleveland warrants declined in price between Monday and Wednesday from 48s. 3d. to 44s. 9d. per ton cash, the close yesterday being 45s. 10½d. cash buyers. The complete collapse in prices thus indicated seems to have been entirely the result of the financial position. As the worst of this, however, is now believed to be over, there is a confident expectation that the market will gradually become steadier. There is a comparatively poor demand from abroad for the iron now in stock in the Glasgow market stores; and consequently shipments are much under the average. Another fact of much interest is the increasing importation of Cleveland iron; and there is also the fact that pig iron is now being brought into the Clyde from Spain. The suspension of work at all the blast furnaces in Scotland with the exception of four still continues; and there is no appearance of the dispute between the furnacemen and the ironmasters coming to a close. A number of the former have fallen into other work, and for the remainder of them the weekly allowance from England is regularly coming to hand.

The coal trade of the West of Scotland is very much depressed; and the price of main coals has undergone a sharp decline—as low as 8s. 4d. per ton having been accepted. Some qualities, however, are quoted at 9s. per ton. Splint coal has fallen in price 3d. per ton; the quotations now ranging between 9s. 3d. and 9s. 9d. per ton. Steam coals are only in quiet demand; and concessions are made in order to effect sales.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 22.

Sulphate of Ammonia.—The market continues in a frail state, though perhaps the despondency is not so great, since the financial crisis is passing away. The question may, therefore, be asked whether these financial troubles had not quite as much as, or even more to do, with the great fall in sulphate values than nitrate of soda; for simultaneously with the supervention of the difficulties of the financial world, the inclination of consumers to operate at the low and tempting prices disappeared. It may, however, still be argued that there being no real pressure to sell anywhere, the reduction in values was far beyond reasonable bounds, even after vindicating every influence and circumstance. What the sharp reduction has really done is to instil such low ideas into consumers' minds as to make business on a fair basis next to impossible. Makers themselves have, however, generally been able to realize better figures than those quoted in the open market. The latter may, therefore, in many instances be taken as fictitious. Such figures as £10 15s. Hull and Liverpool, and less than this f.o.b. Leith, are certainly below the sales reported by makers; and this fact speaks for itself. There is not much change in nitrate; and circumstances indicate that we are very near, if not at, the lowest point. Nitrate and sulphate have had this fact in common—both have been sold "short" here and abroad for months past; and the cutting down of values was favoured by circumstances, and encouraged accordingly. The force of all this seems, however, now well spent; and a further decline in both commodities may be averted. But it is a fact worth noting that, while nitrate since August fluctuated between 8s. 6d. and 8s. per cwt., sulphate ruled between £11 12s. 6d. and £10 17s. 6d.—*i.e.*, a fall of 10s., against 15s. per ton—leaving sulphate in its proper ratio to-day, as supported by the averages of previous years.

LONDON, *Nov.* 22.

Tar Products.—The chief feature of this market is the pressure for benzole for spot delivery. It was thought the higher prices offered for benzole a few months ago were only speculative; and makers discounted the position by selling beyond their production. Most producers are behind with their deliveries; and as the demand for aniline is exceptionally good, the position is causing trouble on all sides. Sales for prompt delivery have been made as high as 4s. 9d. and 3s. 7½d. for 90's and 50's respectively; but for next year's delivery buyers will not give beyond 4s. 6d. and 3s. 6d., if they will even pay this, although sales have undoubtedly been made over the first six months at about these figures. There is a little more inquiry for anthracene; and makers are asking more money. There is a fresh spurt in pitch; and this article is to-day quotable distinctly better. Carbolic acid is absolutely neglected and unsaleable; whilst, owing to the stoppage of the blast-furnace production in Scotland, liquid creosote oils are in improved demand at a higher price. Sales have been made during the week at the following prices: Tar, 29s. 6d. Pitch, 33s. to 35s., according to position. Benzole, 90 per cent., 4s. 7½d.; 50 per cent., 3s. 7d (2d. less in each case for forward delivery). Toluol, 2s. Solvent naphtha, 1s. 9d. Crude naphtha, 1s. 8d. Creosote, 2½d. Heavy oils, 3d. Crude carbolic, 60's, 1s. 6d. Cresol, 9d. Anthracene, 30 per cent., "A" quality (nominal), 1s. 4½d.; "B" quality, 1s.

Sulphate of Ammonia.—Notwithstanding the continuance of the lessened production in Scotland, this market has not improved. Makers unduly pressing their sulphate, and holders of nitrate forcing their stocks as well, together with the extraordinary drop in the Beckton quotation, have conspired to utterly demoralize this market. Sulphate has been sold as low as £10 15s.; and even at this price, buyers are shy. Ammonia liquor is again weaker, and is quoted 5s. to 6s. 9d., according to position and strength.

The Croydon Town Council and the Lambeth Water-Works Company.—The Croydon Town Council, at their meeting yesterday week, decided to promote a Bill in Parliament to empower them to acquire, from the Lambeth Water-Works Company, so much of their plant and rights as relate to the supply of water in South and Upper Norwood and the west wards of the borough, and to enable the Company to dispose of them. For many years the people of Norwood have been anxious to be supplied with water by the Council, who have control of the supply in the whole of the remaining parts of the borough.

Deimel Gas-Lamp Company.—This Company, which has recently, been formed, has taken offices at No. 86, Gray's Inn Road, London, and is now in full work. The Company, which is of the nature of a private syndicate, has the following gentlemen upon the directorate: Mr. T. C. Hersey (Chairman), Mr. Leon Loeb, Mr. S. F. Steadman, Mr. B. B. Van Praagh, Mr. Octavius H. Beatty, Mr. C. H. Wolff, and Mr. Squire Broadbent. For General Manager, Mr. W. M. Hodges has been appointed. The Deimel gas-lamp is of German manufacture, and the value of the patent is its extreme simplicity; it being adaptable to any existing fittings. A full description of the burner will appear in the JOURNAL next week.

Sales of Shares.—At a public sale of shares at Boston yesterday week, five shares in the *Boston Gas Company* sold for £19 10s. each; and seven shares in the *Boston Water-Works Company* realized the highest price on record—namely, £54 each.——At Eckington last Wednesday, 143 old £1 fully-paid shares in the *Eckington and Mosbro' Gas Company* were sold at from £1 14s. to £1 15s. each, and 54 £5 shares realized prices ranging between £6 17s. 6d. and £7 5s. On the same occasion 10 £5 shares in the *Handsworth Woodhouse Gas Company* fetched £7 apiece.——At Dunfermline last Tuesday, 35 shares in the *Dunfermline Gas Company* (£17 10s. paid up) were sold by auction at the upset price of £28 per share.

The Gainsborough Water Supply.—Mr. T. Hawksley has been consulted by the Gainsborough Local Board as to the advisability of continuing to supply the town from the artesian well recently bored at a cost of £6000, or to use the water from the River Trent, as under the old system. He has met the Board, and has expressed the opinion that a new artesian well must be bored at a cost of £15,000 roughly, or water obtained from an unpolluted portion of the Trent, a few miles from Gainsborough, at a cost of £25,000 or £30,000. The Board yesterday week acceded to Mr. Hawksley's request for an analysis of the water in the Trent at two different points, and also from the deep bore, the samples to be submitted to Dr. C. Meymott Tidy.

Proposed Conversion of the Stock of the Bristol Gas Company.—The Bristol United Gas Company are about to promote a small Bill having for its object one or two interesting changes. In the first place, the Directors propose to get rid of the cumbersome name by which the Company is now known, and call it the Bristol Gas Company. Power will be asked for the sale of gas in bulk to local authorities and other bodies. But the most important change of all, from an investor's point of view, is that of the splitting of the stock, and converting the £100 stock, now carrying 10 per cent. dividend, into two lots of £50 each, carrying 5 per cent. Such conversions have, we believe, invariably led to improvements in the market value of stocks so dealt with.

The Water Supply of Stainland.—The Stainland Local Board are not to be permitted to carry out their new water supply scheme without considerable opposition. They are proposing to impound and divert the waters of certain tributaries and streams flowing into the Red Lane Dyke at Coldacre, by means of a reservoir and works to be constructed there; and the riparian owners have determined to take proceedings against the Board to prevent any infringement of their rights. The Clerk of the Board has received a copy of the writ issued by the Chancery Division of the High Court of Justice, at the suit of John Crabtree, for a declaration that the Board are not entitled to take the water at Marshall Syke, Waterloo, and Coldacre Springs; and he has also received notice of motion that the plaintiff would apply for an interim injunction pending the trial of the action.

The Barnard Castle Local Board and the Use of Water Gas.—At the last meeting of the Barnard Castle Local Board, Mr. J. Burn brought up the subject of water gas in connection with a proposal to secure better street lighting. He observed that the people at Barnard Castle had for a long time been dissatisfied with the quality of the gas supplied by the local Company. The Board had had difficulty at times to obtain extensions of mains for lighting the streets; and the Company, unless it were manifestly to their advantage, refused or deferred requests which the Board considered reasonable. He (Mr. Burn) had recently seen the water gas lighting at Harrogate, where it had exhibited superiority over coal gas. It was indeed so esteemed that 27 business firms in James Street—the principal thoroughfare in the borough—sent a memorial to the Corporation asking them to have that street lighted with water gas. He moved, and it was agreed that a Committee be appointed to consider the advisability of procuring a better illuminant than the present one.

The Improvements at the Shrewsbury Water-Works.—The report of the Gas, Water, and Lighting Committee submitted at the last meeting of the Shrewsbury Town Council, stated that, under the advice of the Water Engineer, the tender of Messrs. Simpson and Co., Limited, of London, had been accepted for supplying and fixing a Worthington triple expansion engine and boiler complete for £2900. This statement provoked considerable discussion; some of the members arguing that, by expending such a large sum on an engine, the Committee were departing from the intention of the resolution passed by the Council on the 13th ult., which empowered them to spend £3100, "on condition that if, upon further consideration and inquiry, it were found that any less sum would be sufficient to ensure a continuous supply upon a temporary basis, the expenditure should be reduced accordingly." There was also some question as to where the money required was to come from; but in the end the report was passed—the Town Clerk stating that an amendment, if carried, would not be binding on the Committee. Sir R. D. Green-Price gave notice that he should bring forward a motion at the next meeting in opposition to the Committee's proposal.

The Shocking Affair at the Golborne Gas-Works.—An inquiry was held last Tuesday into the circumstances attending the death of Mr. J. Hinks and Mr. A. Glover at the Golborne Gas-Works last Thursday week, as already reported in these columns. One of the witnesses was Thomas Widdows, who stated that, at the time of the accident, he was engaged with Mr. Hinks, who was the Manager of the works, in attempting to screw up a pipe in the ammonia tank. Mr. Hinks had put a box in the tank to stand upon, having taken the cover off. There was a very strong smell, and almost immediately he exclaimed "the gas is overpowering me." He was then hanging with his head over the side of the tank. Witness held on to him until he was himself overpowered, and fell headlong into the room below; Mr. Hinks falling back into the tank. Evidence having been given as to Mr. Glover being called to the rescue, and jumping in the tank to save Mr. Hinks, Dr. Dobb stated that, when he reached the tank, both men were lying at the bottom quite dead, having been poisoned by inhaling carbonic acid gas and ammonia. The jury returned a verdict that both men were accidently suffocated, but that their lives might have been saved if there had been ventilation and better access to the tank.

Huddersfield Corporation Gas and Water Supply.—At the last meeting of the Huddersfield Town Council, the usual statement was made on the working of the various departments during the municipal year. With regard to the gas-works, the amount of coal and cannel used was 44,030 tons, as against 42,585 tons in 1889—being an increase of 1445 tons. The gas consumed in 1889 amounted to 462,884,000 cubic feet; and in 1890, to 483,018,000 feet—an increase of 30,184,000 feet. The average illuminating power of the gas during the year was 20·15 candles, as against 20·40 candles in 1889. New plant for the manufacture of sulphate of ammonia had been completed, and promised to become a valuable adjunct to the prosperity of the gas-works. Regarding the Water Department, it was stated that the amount of water supplied for trade purposes by meter inside the borough was 397,036,000 gallons; outside the borough, 63,673,000 gallons—making a total of 460,709,000 gallons, as compared with 439,727,000 gallons in 1889; being an increase of 21 million gallons, or 5 per cent. The population supplied with water in 1880 was 98,815, as compared with 136,610 at the present time. The income for water in 1880 was £23,841, as compared with £46,541.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1088.)

Issue.	Share	When ex-Dividend.	Dividend or Div. Bonus.	NAME.	Paid per Share.	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Oct.	10½	Alliance & Dublin 10 p. c.	10	16—17	..	6 3 6
100,000	10	,,	7½	Do. 7 p. c.	10	12—13	..	5 15 6
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
100,000	20	30 May	8	Bahia, Limited	20	19—21	—1	7 12 4
200,000	5	13 Nov.	7½	Bombay, Limited	5	6½—7¼*	..	5 3 5
40,000	5	,,	7½	Do. New	4	5—5⅝*	..	5 9 1
380,000	Stck.	14 Aug.	12½	Brentford Consolidated	100	212—217	..	5 12 11
125,000	,,	,,	9½	Do. New	100	155—160	..	5 15 7
220,000	20	11 Sept.	11½	Brighton & Hove Original	20	40—42	..	5 9 6
320,000	20	28 Mar.	11½	British.	20	43—45	..	5 0 0
50,000	10	11 Sept.	11	Bromley, Ordinary 10 p. c.	10	18—20	..	5 10 0
39,000	10	,,	8	Do. 7 p. c.	10	13—14	..	5 14 3
328,750	10	13 Nov.	6	Buenos Ayres (New) Limited	10	11—12*	..	5 0 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	103—106	..	5 13 2
150,000	20	14 Aug.	8	Cagliari, Limited	20	25—27	..	5 18 4
550,000	Stck.	10 Oct.	13½	Commercial, Old Stock	100	248—253	..	5 8 8
130,000	,,	,,	10½	Do. New do.	100	198—203	..	5 5 11
130,000	,,	27 June	4½	Do. 4½ p. c. Deb. do.	100	119—124	..	5 12 7
557,320	20	13 June	13	Continental Union, Limited	20	47—49	—1	5 6 2
242,680	20	,,	13	Do. New '69 & '72	14	34—36	..	5 1 6
200,000	20	,,	10	Do. 7 p. c. Pref.	20	39—41	..	4 17 7
75,000	Stck.	25 Sept.	10	Crystal Palace District	100	190—200	..	5 0 0
234,060	10	16 July	—	European, Limited	10	19—20	..	—
120,000	10	,,	—	Do. New	10	19—20	..	—
354,060	10	,,	—	Do. do.	7½	13½—14½	..	—
5,470,620	Stck.	14 Aug.	13	Gaslight & Coke, A, Ordinary	100	234—238	..	5 9 2
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	98—101	..	3 19 3
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	247—252	..	3 19 4
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	119—123	..	4 1 3
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	177—182	..	4 2 5
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	164—168	..	4 3 4
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	246—251	..	3 19 8
1,061,150	,,	13 June	4	Do. 4 p. c. Deb. Stk.	100	113—118	..	3 7 10
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	123—128	..	3 10 4
650,000	,,	,,	6	Do. 6 p. c. do.	100	160—164	..	3 13 2
3,800,000	Stck.	13 Nov.	12	Imperial Continental	100	214—218*	—1	5 10 1
75,000	5	13 June	6	Malta & Mediterranean, Ltd.	5	5⅛—5⅜	..	5 4 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109—111	..	4 10 1
541,920	20	13 June	7½	Monte Video, Limited	20	19—20	..	6 10 0
150,000	5	30 May	10	Oriental, Limited	5	9—9½	..	5 5 3
60,000	5	25 Sept.	7	Ottoman, Limited	5	3—3⅛	..	5 7 3
166,870	10	16 July	4	Pará Limited	10	3—4	..	10 0 0
420,000	100	3 Nov.	6	People's Gas of Chicago—1st Mtg. Bds.	100	95—100	..	6 0 0
500,000	100	2 Dec.	6	2nd Do.	100	95—100	..	6 0 0
150,000	10	10 Oct.	10	San Paulo, Limited	10	16—17	+½	5 17 8
500,000	Stck.	28 Aug.	13½	South Metropolitan, A Stock	100	285—290	..	4 11 4
1,350,000	,,	,,	11½	Do. B do.	100	228—233	..	4 18 9
141,500	,,	,,	12	Do. C do.	100	235—245	..	4 17 11
650,000	,,	27 June	5	Do. 5 p. c. Deb. Stk.	100	142—147	..	3 8 0
60,000	5	11 Sept.	11½	Tottenham & Edm'nton, Orig.	5	11—13 *ExDiv.	..	4 8 5
				WATER COMPANIES.				
728,446	Stck.	13 June	9½	Chelsea, Ordinary	100	270—275	..	3 9 7
1,720,560	Stck.	10 Oct.	7½	East London, Ordinary	100	211—216	..	3 9 5
544,440	,,	27 June	4½	Do. 4½ p. c. Deb. Stk.	100	142—147	..	3 1 2
700,000	50	13 June	9	Grand Junction	50	120—125	..	3 12 0
708,000	Stck.	14 Aug.	10½	Kent	100	271—276	..	3 16 0
1,043,800	100	27 June	9½	Lambeth, 10 p. c. max.	100	248—253	..	3 13 1
406,200	100	,,	7½	Do. 7½ p. c. max.	100	197—202	..	3 14 3
260,000	Stck.	25 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120—124	..	3 4 6
500,000	100	14 Aug.	12½	New River, New Shares	100	361—366	..	3 6 3
1,000,000	Stck.	31 July	4	Do. 4 p. c. Deb. Stk	100	124—128	..	3 2 6
902,300	Stck.	13 June	6	S'thwk & V'xhall, 10 p. c. max.	100	168—173	..	3 9 4
126,500	100	,,	6	Do. 7½ p. c. do.	100	158—163	..	3 13 7
1,155,666	Stck	13 June	10	West Middlesex.	100	280—285	..	3 15 6

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." TELEPHONE No. 2698.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co. for Gas Exhausters, &c.

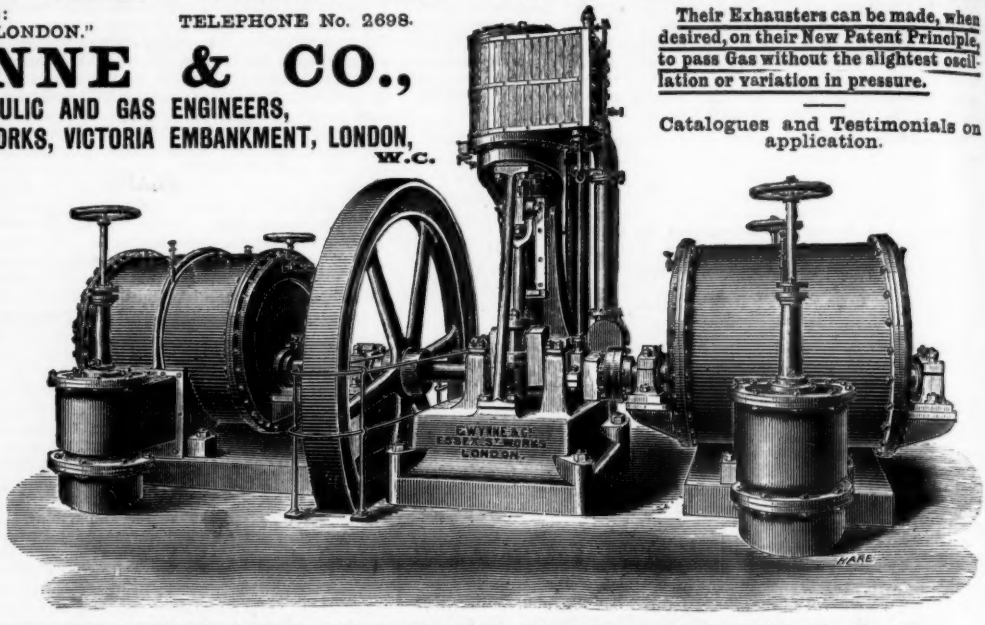
They have completed Exhausters to the extent of 29,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

Catalogues and Testimonials on application.



Exhausting Machinery at Fulham and Bromley Gas-Works—each set passing 400,000 cub. ft. per hour, drawing 14 miles distant from Beckton.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAYS.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH. Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.

Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 85, Gracechurch Street, LONDON; 70, Wellington Street, GLASGOW; 10, Marsden Street, MANCHESTER; and 96, Reade Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.

Head Office: MIDDLESBROUGH. Correspondence invited.

EXTRACT from the Harrogate Gas Company's Report, dated the 5th of February, 189 : Coal consumed, 8600 tons. Gas made, 93,880,000 feet; ditto sold, 84,880,000 feet; ditto unaccounted for, 8,000,000 feet; quantity made per ton, 10,800 feet; ditto sold, 9869 feet. Illuminating Power, 16·1 candles. Coals used, Brancepeth. Owners, Strakers and Love, Newcastle-on-Tyne; who have also Brandon Hutton Seam Unscreened Gas Coal. Analysis, 10,500 cubic feet per ton; Illuminating Power, 16·2 candles.

WANTED, by a competent Man, a situation as FOREMAN or INSPECTOR. No objection to going abroad. Several years in last situation.

Address No. 1883, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Competent Man, a Situation as SERVICE LAYER, METER FIXER, INDICE READER, MAIN TESTER, &c. Fifteen years' experience in general outside Work. Good references.

Address A. B., 16, Station Street, STRATFORD, E.

SCOTCH GAS COALS.

A Gentleman connected with Gas Companies in South Wales would treat with view to AGENCY OF SCOTCH GAS COALS.

Address No. 1876, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.

Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.

*** See Advertisement p. 1032 of last week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock, Oldham."

SULPHURIC ACID, B.O.V., for Sulphate of Ammonia Making. Guaranteed clear, of full strength, and to produce a fine white-coloured salt, Delivered in carboys or railway tank waggons.

For prices and terms address BALE, BAKER, AND CO., 120 & 121, Newgate Street, LONDON.

TAR and Liquor wanted. BROTHERTON AND CO., Commercial Buildings, LEEDS.

WANTED, two good Retort-House FOREMEN. Also several good STOKERS used to Shovel Charging.

Apply to the MANAGER, Gas-Works, COVENTRY.

WANTED, a Representative who can SELL GAS COAL, and has a connection in the Eastern Counties.

Apply, by letter, giving full particulars, to No. 1878, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a large second-hand WASHER, in perfect condition.

State price and full particulars to J. HARDMAN AND Co., Tunstall, STOKE-ON-TRENT.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.

Address, stating price per ton and quantity, No. 1766, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Practical Chemist and ANALYZER, well up in Gas Testing for Sulphur Compounds and other Impurities, thoroughly understanding the use of Photometer, and Testing for Illuminating Power for a Gas Company making over 600 millions per annum. It is important that the Applicant should have held a similar appointment.

State salary required, and send copies only of two testimonials, to E. T., care of Messrs. Charles Barker and Sons, 8, BIRCHIN LANE, E.C.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importer from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased. 120 and 121, NEWGATE STREET, LONDON, E.C.

TUBES.

FOR Gas, Steam, and Water; Galvanized White Enamelled, and Hydraulic Tubes, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY, and 14, Great St. Thomas Apostle, LONDON.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. For Illustrated Advertisement of this System, see p. 932.

Inquiries should be addressed to THE AUTOMATIC COAL-GAS COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

HUTCHINSON BROTHERS, Barnsley Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c., Tools and Sundries.

BENTLEY & CO.

MANCHESTER ELECTRICAL STORES.

FOR Batteries, Bells, Wires, and Special Electrical Apparatus, address the best house 17, NEWTON STREET, PICCADILLY, MANCHESTER.

FOR SALE—Seven Purifiers, 15 feet square, with Sieves, Connections, Valves, and Lifting Apparatus complete.

One PURIFIER, 20 ft. by 16 ft., with Sieves, Connections, Valves, and Lifting Apparatus complete.
Two Wrought-Iron TANKS, 8 feet diameter by 7 feet and 6 feet respectively.
One REID'S GAS WASHER.
Two Cast-Iron TANKS, 15 ft. 8 in. diameter by 11 ft. 4 in. and 8 ft. 6 in. respectively.
Two EXHAUSTERS (Jones), equal to 25,000 cubic feet per hour.
A number of 15-inch and other VALVES.
A quantity of SHAFTING and PULLEYS.

J. HEPWORTH.
Gas-Works, Carlisle, Nov. 14, 1890.

FOR SALE—A 100,000 cubic feet per hour ROTARY GAS EXHAUSTER.

Apply, by letter, to No. 1879, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO BE LET, on Lease, a small GAS-WORKS, with a good Coal Business.

For particulars apply to GEO. WRIGHT, Hogsthorpe, Alford, LINCS.

SPENT OXIDE.

THE Eccleshill and Bolton Gas Company invite OFFERS for about 30 tons of SPENT OXIDE.

Samples may be obtained on application to JAMES LEE, Manager, Gas-Works, Eccleshill, YORKSHIRE.

GAS TAR.

THE Malton Gas Company invite TENDERS for the surplus TAR produced at their Works (about 100 tons), delivered on Rail at Malton in Contractor's casks.

HENRY TOBEY, Secretary.

Malton, Yorks.

RETORTS AND FIRE-BRICKS.

THE Directors of the Rochester, Chatham, and Strood Gaslight Company are prepared to receive TENDERS for the supply of 1200 feet run of CLAY RETORTS, 54,000 FIRE-BRICKS, 50 TILES, and 50 tons of CLAY, according to specification and form of tender, which may be had on application at their Office, 58, High Street, Rochester, where tenders must be delivered before Noon on Thursday, the 18th of December, 1890.

By order,
WILLIAM SYMS,
Secretary and Engineer.

Nov. 22, 1890.

BROADSTAIRS GAS COMPANY.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Broadstairs Gas Company invite TENDERS for their surplus TAR and LIQUOR, for One year from the 31st of December next.

Tenders, endorsed "Tender for Tar and Liquor," to be sent in, directed to the Chairman, not later than the 1st day of December next.

The Directors do not bind themselves to accept the highest or any tender.

W. J. LATCHFORD,
Secretary and Manager.

Gas Offices, Broadstairs,
Nov. 12, 1890.

FIRE-CLAY GOODS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of FIRE-CLAY GOODS (Retorts, Bricks, &c.) required for repairs at the Neepsend and Effingham Street Stations during the next Twelve months.

Specifications and forms of tender may be had on application to the Company's Engineer, Mr. Fletcher W. Stevenson.

The Directors do not bind themselves to accept the lowest or any tender.

Sealed tenders, marked "Tender for Fire-Clay Goods," must be delivered to the undersigned not later than Tuesday, Dec. 2, 1890.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
Nov. 15, 1890.

FOR Distribution among Gas Consumers or at Exhibitions.—A 4pp. Leaflet entitled "THE USE OF GAS-STOVES IN OUR HOMES;" being a reprint of an article from the *Home Provider*. Price 3s. 6d. per 100. Special quotations for larger quantities, and, if required, for printing Gas Company's own announcement on first or last page. Specimen copy, free by post, 1½d.

The Leaflet is very suitable for distribution among Gas Consumers in the provinces, as it shows the great progress which is being made in the use of Gas for Cooking and Heating in London, and points out, briefly and clearly, the many advantages of Gas-Stoves.

May be obtained of S. H. E. FOXWELL, Office of the *Home Circle and Provider*, 48, Temple Chambers, TEMPLE AVENUE, E.C.; and of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

FIRE-HYDRANTS.

THE London County Council invite TENDERS from persons who may be willing to undertake to supply, during three years from the 1st of January, 1891, as many FIRE-HYDRANTS as the Council may require the Metropolitan Water Companies to fix in their respective Districts at the Council's expense. The number that will be required cannot be specified, but 500 will be needed at once, and probably several hundred more will be required during the three years; and the Hydrants will have to be delivered at the Works of the various Water Companies.

A pattern Hydrant may be seen at the County Hall in Spring Gardens, where also forms of tender may be obtained.

Tenders to be addressed to the Clerk, London County Council, Spring Gardens, S.W., endorsed "Tender for Fire-Hydrants," and to be delivered not later than Ten a.m., on Thursday, Dec. 4, after which time no tender will be received.

The Council does not bind itself to accept the lowest or any tender.

H. DELA HOOKE,
Clerk of the Council.

Spring Gardens, S.W.,
Nov. 22, 1890.

ROYAL NAVAL EXHIBITION, 1891,
Patron, HER MAJESTY THE QUEEN.
President, H.R.H. THE PRINCE OF WALES, K.G.,
Honorary Admiral of the Fleet.

FIRMS intending to exhibit objects connected with the Royal Navy or Maritime interests in general are reminded that all applications must be received by the 30th of November.

Owners of Paintings, Drawings, Naval Relics, Mode's, &c., are invited to apply for Loan Forms and Regulations.

For particulars address Captain ALFRED JEPHSON, R.N., Honorary Secretary, 6, Craig's Court, LONDON, S.W.

MR. W. H. BENNETT having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their Inventions may be secured for Twelve months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 23, Great George Street, WESTMINSTER.

INCORPORATED INSTITUTION OF GAS ENGINEERS.

NOTICE is hereby given, that the above Institution having been formally Incorporated, the Council are prepared to receive APPLICATIONS FOR MEMBERSHIP.

Forms and particulars may be obtained from the undersigned.

JAMES L. CHAPMAN,
Secretary pro tem.

Gas Office, Harrow, Middlesex,
Nov. 22, 1890.

Price 6s., Cloth Bound, Bevelled Boards,

THE

GUIDE-FRAMING OF GASHOLDERS

AND OTHER PAPERS

CHIEFLY RELATING TO

STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS.

BY

F. SOUTHWELL CRIPPS, Assoc. M. Inst. C.E.

Reprinted from the JOURNAL OF GAS LIGHTING. *Fully Revised and Corrected by the Author, with many Additions.*

LONDON:

WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter; and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

THE BEST AND SIMPLEST SYSTEM OF

VALVES FOR PURIFIERS

Is Weck's Patent arrangement of Three-Way Disc Valves, either separate for Purifiers fixed in line, or arranged together as a

CENTRE-VALVE

When the Purifiers are fixed in square.

No Leakage. No Foul Gas passed in changing. All the Purifiers in action, or any less number. Clean Box emptied of Air before taking into use.

DESCRIPTIVE PAMPHLET ON APPLICATION.

F. WECK,
JOHN BRIGHT ST., BIRMINGHAM.

PATENT SULPHATE OF AMMONIA PLANT.

C. & W. WALKER.

PATENT MURIATE OF AMMONIA PLANT.

PATENT LIQUID AMMONIA PLANT.

PATENT TAR PLANT.

Makers of the most perfect form of Apparatus for the Manufacture of Sulphate, Muriate, Liquid Ammonia, and Tar Products.

Apparatus already erected have proved more economical in consumption of Fuel, Simplicity, and Cheapness of Working than any known Plant.

Sole Makers of Claus' Patent

SULPHUR RECOVERY PLANT

for recovering Sulphur from Waste Gases containing Sulphuretted Hydrogen.

Testimonials & Estimates on Application.

8, FINSBURY CIRCUS, LONDON, E.C.; MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

ADDRESS

JAMES WHITE & Co.,

ALBERT WORKS, WIDNES.

COKE BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT.)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,

PARK STREET, SOUTHWARK, E.C.

SOOTHILL WOOD CANNEL.

Yield of Gas per Ton, over 12,000 Cubic Feet.
Illuminating Power - - - - - 26 Candles.
Coke per Ton, - - - - - - - 57 per cent. of a quality almost equal to that made from the best Coking Coal.

For Analysis and Price, apply to

The Soothill Wood Colliery Co., Ld.,

SOOTHILL WOOD COLLIERY,

BATLEY, YORKSHIRE.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

For Prices and complete Analysis, apply to

YOUNG, DANCE, & CO.,

COAL OWNERS, NEWCASTLE-ON-TYNE,

Or E. FOSTER & CO., 21, John St., Adelphi, LONDON, W.C.

PREPARED OXIDE OF IRON

FOR PURIFYING COAL GAS.

As extensively used in Yorkshire, Lancashire, the Midlands, and Abroad.

Manufacturers: BAILES & HALLSWORTH,

Armley, Leeds, & at Bradford, Manchester.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD.

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

MIRFIELD, NORMANTON.

GAS AND WATER PIPES.

1½ to 12 IN. BORE.

THOMAS ALLAN & SONS,

Bon Lea Foundry,

SOUTH STOCKTON-ON-TEES.

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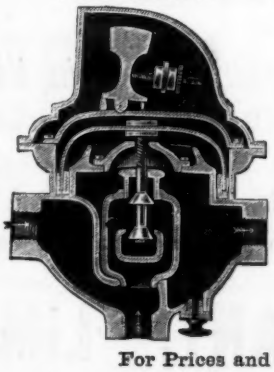

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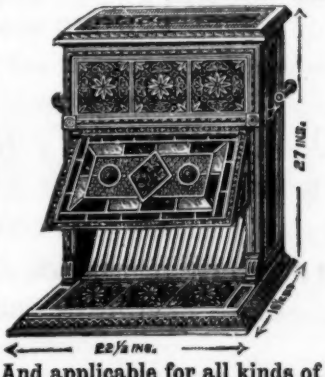

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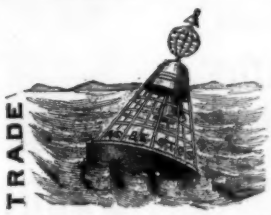

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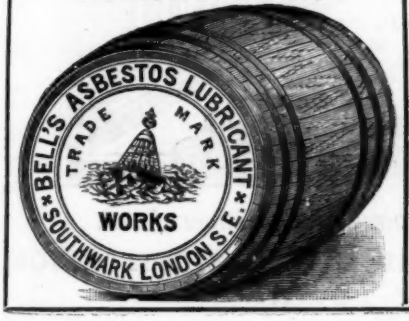

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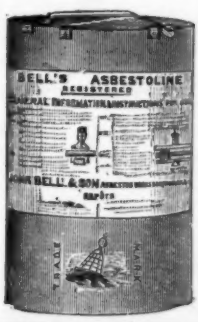

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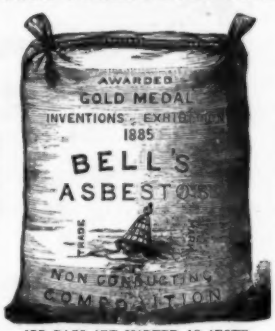

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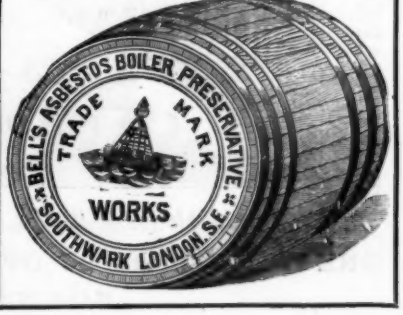

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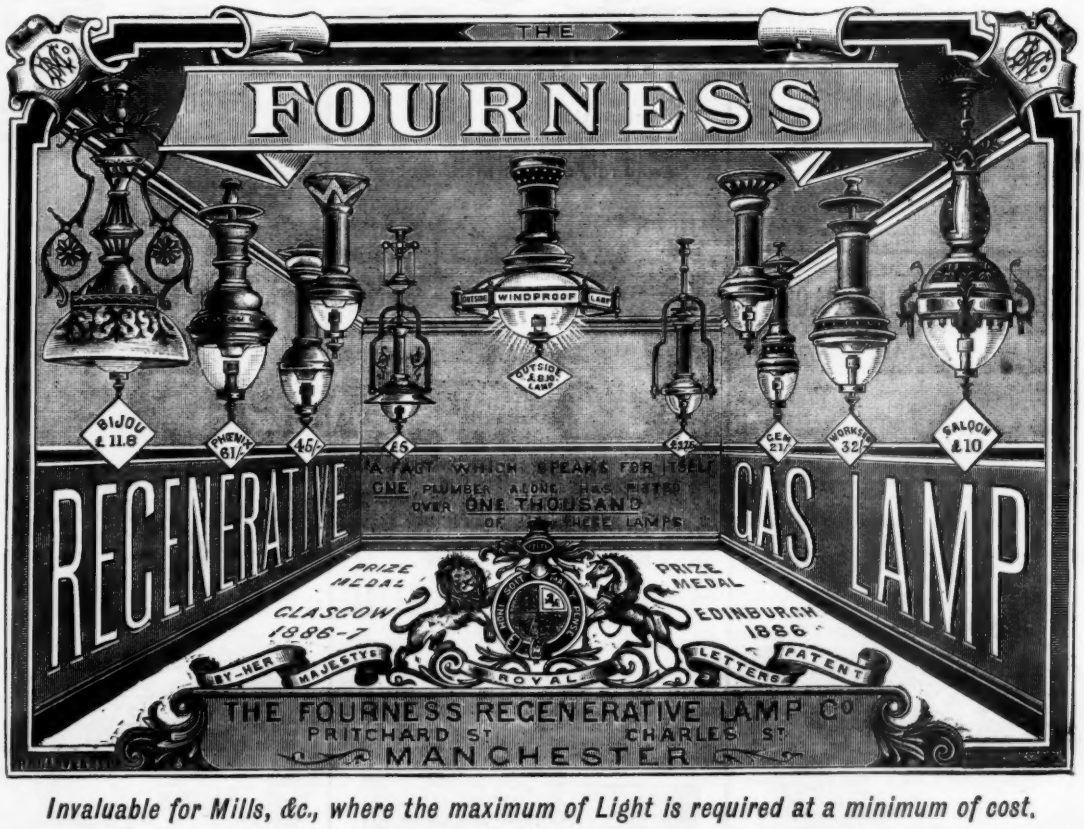

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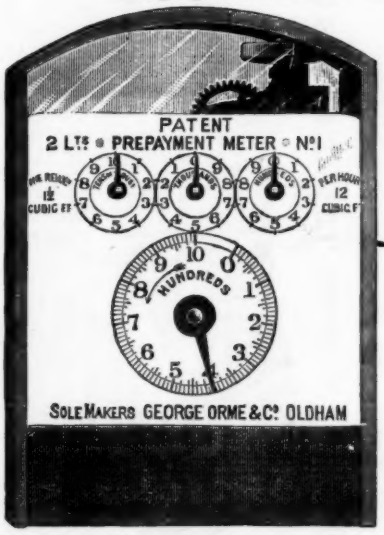

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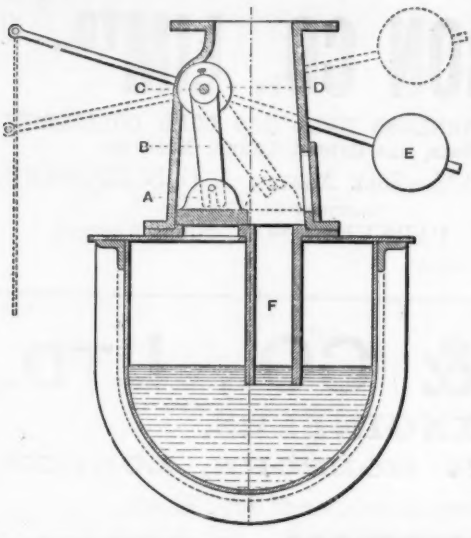

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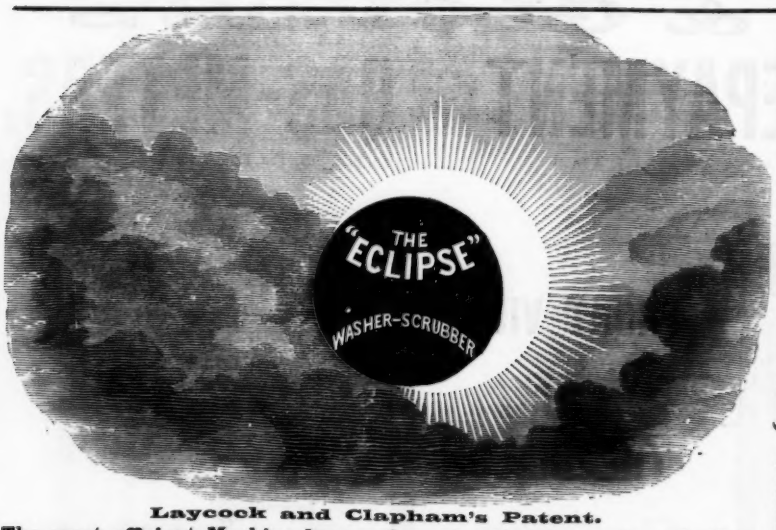

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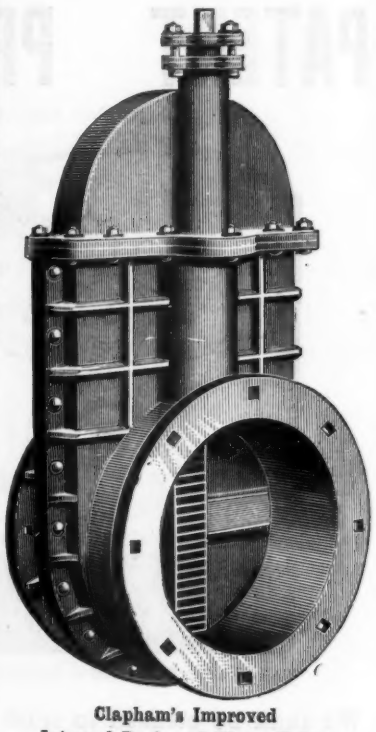
SILVER MEDAL, Inventions Exhibition, 1885.



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